THE M.A.H.A. MAGAZINE

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EDITORIAL.

We have now completed the first year of the *M.A.H.A. Magazine* in its new and revised form and with this issue, we commence Volume four.

We are grateful for the support we have received during the past year and our list of regular subscribers has increased encouragingly month by month. It is, however, not yet long enough to satisfy our voracious appetite and we appeal to our readers to give us their assistance in making this Magazine more widely known. It is to be expected that the revival of a publication during a period of general depression must of necessity be a slow process and we are reasonably satisfied with the progress made. There must be, however, hundreds of amateur gardeners and enthusiasts interested in the agricultural development of Malaya whom this Journal has not yet reached and we hope that at the close of this year, we shall be able to record a very much larger number of regular readers.

We refer above to the general depression so adequately described by that much overworked word, the " Slump." It has been said that the slump will end when we cease to talk about it. That suggests perhaps a too literal triumph of mind over matter, but it is sound common-sense nevertheless and the real meaning is clear. We must give up comparing present day conditions with those existing a few years ago and instead look upon them as new basic standards from which to start anew. The pessimist rarely achieves success but the optimist who goes to his office each day with a sense of anticipation of good things to come if they are worked for will inspire his staff with the same enthusiasm, and instead of complaining that business is falling off, he makes up his mind that things are not as good as they will be.

We are just starting a new year after two thoroughly bad ones and everywhere the outlook is bright. Malaya has definitely turned the corner and if we all make up our minds to ban the forbidden word from our vocabulary, we shall have forgotten its meaning by the end of the year.

Eleventh Malayan Exhibition.

The quarterly notes of the Malayan Agri-Horticultural Association in this issue draw attention to the fact that the Eleventh Malayan Exhibition will be held this year during the King's Birthday Holidays, the 2nd, 3rd and 4th June.

The Malayan Exhibition is a recognised annual institution and it is difficult to assess accurately its undoubted value.

In the agricultural and oils and fats sections, exhibits for competition have improved year by year and the schedules are revised annually in the light of experience gained, classes being added and amended to meet changing conditions and the more extensive cultivation of to-day.

This year the newly evolved Malayan Padi Competition will be staged at the Exhibition when the winning exhibits from District Shows in the various States will be judged for the distinction of being declared the best padi in Malaya and for an attractive list of awards.

In the other competitive sections, improvement is marked each year and more and more space has to be allotted to accommodate exhibits.

As to the Trade Section, we have on a previous occasion stated our view that the Malayan Exhibition provides the " shop window " of Malaya and we confidently forecast that the business completed at this year's Show will strikingly reflect the new era of prosperity now ushered in.

Index to Volume 3.

As a single volume of the *M.A.H.A. Magazine* is considered somewhat thin for binding, it is suggested that two volumes should be bound together and accordingly an index for volumes 3 and 4 will be issued at the end of this year.

It has been found necessary to increase the price of the *M.A.H.A. Magazine* to 30 cents per copy or 36 cents post free, and the annual subscription to $1.20 post free in Malaya. Subscriptions should be addressed to the Editor, 12 Barrack Road, Kuala Lumpur.

Horticulture.

HEDGES

BY

THE REV. KEPPEL GARNIER.

Six and a half years ago it was the fortune of the writer to move into a new house built on a corner site with an area of about one and three quarters acres in all. The land had been paddie ground and at the time of moving in there was not even a blade of grass—not a tree nor a shrub. The house was built to face the spot where the roads crossed—an arrangement which made the layout of the ground rather a difficult matter to plan. The first thing that was done was to have a stone path leading direct from the front door straight down to the corner where the roads crossed. This was broken by a square pavement halfway down the path with a bird bath on a stone pedestal, and the end terminated in a path which ran round a circular bed planted with *Allamanda cathartica*. Then a fairly big circle was drawn with the bird bath as the centre, and this was planted with bamboo and formal beds were laid out on the ground so enclosed. This was the first hedge planted and now after 6 years it is about 6 feet high and three feet thick. It is kept clipped to resemble a yew hedge at home. Then a boundary hedge of Hibiscus was laid down to mask the houses on each side, and along one of the boundary roads where there was a very deep ditch—first a hedge of pink bougainvillea was planted, then came a gravel path and then a hibiscus hedge. This path ran from the entrance gate to the circular path round the bed of Allamanda at the end of the stone pavement.

The entrance mentioned here came in at an awkward angle from the road, leaving too little ground to do much planting of trees or shrubs; and something had to be done to ensure privacy. Hedges seemed to be the only solution. The question was what kind of Hedge. Bamboo and Hibiscus were ruled out as being rather ordinary. The writer had however noticed in some of the old gardens in Penang a dark leafed plant which made an excellent hedge and also, in the country outside—and especially round and rural Police Stations—yet another hedge which when clipped looked exceedingly neat and tidy. After considerable investigation there was discovered a large area of waste ground opposite the main gates of Glugor House where both these plants were growing wild. Many expeditions were made there and besides the two already mentioned, two more plants were found which looked as if they would be successful as Hedge plants; and all four were searched for and dug up and replanted where it was considered they were most needed in the new garden. This was not done till two years after occupying the new house, so that now they are about four years old. But it only took two years for them to achieve a handsome and satisfactory appearance and as they are excellent in every way

their names are recorded here for the assistance of other gardeners who may require something uncommon for their gardens in the way of boundary or ornamental hedges. The most satisfactory, in some ways, of the four is *Streblus asper*. It has harsh dark green leaves but trims exceedingly neatly. It has a most vigorous growth and makes a sturdy hedge and when clipped resembles a yew hedge at home owing to its dark green colour. Mr. Holttum has written to say that it is widely distributed in Southern Asia but in the Peninsula only occurs in the North. It was certainly used very frequently as a garden hedge in Penang in years gone by—for there are many evidences of it in the older gardens though it has been neglected lately.

The next plant in order is *Acalypha siamensis* with the Malay name of Tumput. This is found as a rule in sandy open country in the north of the Peninsula and on the east coast and is distributed northward into Siam. It seems to have been adopted as the boundary hedge for all the rural Police Stations in the island but it is to be found also planted round Malay houses in Jelutong and other kampongs outside the Town.

It makes an exceeding neat and tidy hedge—neater when closely clipped than *Streblus asper* but it is not as strong and probably would not be strong enough to keep cattle out of the compound.

The third plant *Ehretia microphylla* has shining dark green leaves and minute flowers. It has been used a great deal by Chinese gardeners in Penang for topiary work. Those who know the Ayer Itam Temple will remember certain porcelain heads and hands—representing an English Sailor and soldier and a Sikh—the bodies of which are formed from this plant cut into proper shape. Once planted in the garden it is difficult to eradicate as it produces seedlings in great quantities. It is a useful hedge because of this and because of its quick growth. It also looks extremely well when cut and trimmed, and is strong enough to protect any garden from the incursions of cattle or other unwanted trespassers.

The fourth plant is *Triphasia trifoliata* or the Lime berry. It is a native of China and although not so common as the first three is now to be found fairly frequently in Penang island grown as a small bush. As a hedge it is not so neat as the other three but owing to its formidable thorns it will keep out anything—four and two footed. In the writer's garden it has been found useful to mix it with *Acalypha siamensis*; it is then neater than when planted by itself and stronger than the *Acalypha siamensis* alone.

In the same way it is found that *Ehretia microphylla* is most useful for planting with any other ordinary hedge plant. The original bamboo hedge which was getting a little ragged at the bottom has now been reinforced by it and the effect is good though in all probability it will replace the bamboo in time.

On the whole it would seem that *Streblus asper* is the best hedge as a protective boundary hedge. It is consistently thick from top to bottom and is sufficiently woody to keep out intruders. Acalypha is better used as an enclosure of some particular portion of the garden as it is extremely neat

without being very much good as a protection against straying animals. *Ehretia microphylla* is so wonderfully prolific that it is always available to fill up weak places in existing hedges while at the same time it is sufficiently handsome to be used alone for decorative purposes.

Triphasia trifoliata owing to its strong thorns can always be used where protection is particularly desirable and owing to its small brilliantly red fruit it is at the same time attractive to the eye but its growth is not close enough to make it a perfect hedge by itself.

None of these four plants have the disadvantages inseparable from the bambo or the hibiscus—white ants do not seem to be attracted by them and so far they are very healthy and show no weak places—such as are often found in hibiscus hedges.

INSECT PESTS OF ORNAMENTAL PLANTS *

BY

N. C. E. MILLER, F.R.E.S.

Ag. Government Entomologist, Department of Agriculture.

I should like to preface the remarks I am about to make, with the explanation, that all the insects referred to in this paper are designated by their scientific names, for the obvious reason that they have no others. To some people this may appear unfortunate, but on giving the matter a little thought, one will realise that it is just as easy to remember a scientific name, as an English name. Malay names, when they exist, are not at all helpful, in fact, considerable confusion is liable to arise by their use, since groups of insects are referred to by one word, in many cases.

The gardener in this country has to contend with a considerable number of insects which are sometimes only moderately injurious, but are frequently the cause of great disappointment by making a sudden appearance and doing irreparable damage to some particularly choice plants.

Insects may be roughly separated into two categories, those which obtain their food by biting pieces from the plant, and those which feed by sucking plant juices.

Biting insects in both the larval and adult stages, or in the larval stage alone feed by removing portions of the leaves or stem of a plant by means of their mandibles.

Sucking insects in both the larval and adult stages are provided with piercing mouthparts which they insert into plants and suck up the juices, in much the same manner as a mosquito when feeding on blood.

It will be realised, therefore, that different types of spray fluids will be essential in order to control insects which obtain their food by different methods, that is to say, against biting insects some forms of stomach poison must be used, while against sucking insects, it will be necessary to employ such substances as will affect their respiratory system; a fluid of this kind is called a contact poison. It should be mentioned that biting insects also may be affected by a contact poison.

I will now give a brief review of the biting insects most commonly met with in flower gardens and which are, at the same time, important pests.

Probably the most troublesome pests are various species of beetles, which fly at night, and sometimes conceal themselves during the day in the soil close to the plants they have been feeding on.

There are several species of these beetles, but it will be sufficient to exhibit the commonest ones only, to avoid confusion.

* A lecture given in October 1933 to the Selangor Gardening Society in the Gardens, Kuala Lumpur.

Their names are *Apogonia cribricollis Aprosterna pallida Protaetia acuminata, Lepadoretus vitticauda* and *Anomala Antiqua.* The plants most frequently damaged are Roses, *Dahlias, Cannas* and *Zinnias.*

Measures recommended for the control of these beetles are, first, collecting them at night, with the aid of a torch or some sort of lamp, second, by spraying the plants with lead arsenate solution. A search may also be made during the day time for the beetles concealed in the soil.

Another beetle which is occasionally very troublesome, is *Lema pectoralis,* which in both the larval and adult stages is destructive to orchids of the *Vanda* group. The presence of larvae of this species is rendered conspicuous by the whitish foamy (soap like) substance which covers them.

If the number of plants attacked by the species is very large, it is best to use lead arsenate spray, but otherwise it will be found more economical to pick off the larvae and beetles by hand and destroy them.

The large grasshopper, *Valanga nigricornis* now and then does some damage to such plants as *Cannas,* but it is rarely if ever an important pest in this country. It will be found necessary to use a net in order to catch the adult which is a powerful insect, but it, as well as the larvae may be captured with the hand.

An occasional pest and a very destructive one, is *Brithys crini,* a moth whose larvae feed principally on *Zephyranthes, Amaryllis* and *Crinum.* It has also attacked Madonna Lily on one occasion. These larvae, as will be seen by the dried specimens which are here exhibited, are conspicuously coloured, and even if the damaged plants did not attract ones attention to the fact that some pest or other was present, it is hardly possible to overlook such larvae.

The feeding habit of this species is usually to eat away the leaves from the edges, but it will also bore into the stems of leaves, for example in *Amaryllis* and, naturally while in this position it is inaccessible to any form of control by spraying.

Usually, it will be more practicable to collect the larvae of this species by hand and then destroy them by dropping them into a receptacle containing boiling water. If it is desired to rid the plant of them by means of a poison, lead arsenate should be used.

If the larvae have bored into the leaf, there is no other remedy than to cut off the leaf and destroy it, along with the pests. The adult moth is rarely seen, being nocturnal, but occasionally it is attracted to artificial light.

Plants belonging to the family Convolvulaceae such as *Ipomoea* are attacked by the Tortoise beetle *Aspidomorpha miliaris* both adults and larvae; which will rapidly defoliate an extensive area of this climber.

A stomach poison is obviously the most effective means of control, but on the other hand, there appears to be something to be said for a spray made from Tuba root. Laboratory experiments which I have recently carried out indicate that Tuba root solution has a distinctly repellant effect. The experiment in this instance consisted of spraying living plants of *Ipomaea purpurea*

with a solution of Tuba root, prepared in the proportions of 4 lbs. of root to 10 gallons of water. When the liquid from the spray had dried off the leaves and stems, a number of healthy larvae of *A. miliaris* was placed on them. On examining the plants the following day it was found that none of the larvae had fed and some had actually died. More larvae were put on to replace the dead ones, but again no feeding took place and larvae died. As far as one can judge, the inference is that tuba solution in this instance acts as an asphyxiant, to this species of beetle, at all events. The asphyxiant properties of a tuba solution would not be very lasting, during rainy weather, I should imagine.

An allied species of beetle *Callispa 12-maculata* Chap., has been recorded as attacking the orchid *Spathoglottis plicata* Bl. Either spraying with lead arsenate or handpicking may be carried out for its control.

The hawk moth *Cephonodes hylas* L., is an insect which has been frequently reported as causing extensive damage to coffee; in fact, in certain instances the larvae had so completely defoliated the bushes, that they were reduced to feeding on what remained of the leaf stems and on green berries. This species will also attack *Gardenia* species but if a thorough search is made for the larvae, it is not difficult to rid a garden of them. Alternatively, of course, a stomach poison may be used.

Certain larvae of moths feed between leaves, the edges of which they have drawn together and fixed with silk. An example of this type of what are called "leaf rollers" or leaf folders is the moth *Sylepta derogata*, a pest of *Hibiscus* species. Owing to their living more or less in concealment, one cannot always be sure that a stomach poison, will be effective, so it is recommended that the rolled up leaves be plucked, even if spraying has also been resorted to.

A moth whose larva is frequently a troublesome pest is *Agrotis ypsilon*. The larvae of this species are commonly called "cutworms" owing to their habit of biting through the base of the stem of a plant, causing it to fall over. This insect is more abundant in hill country, but has been recorded on the plains.

Feeding by these larvae takes place almost exclusively at night. In the day time they hide among herbage, or in the soil, in the vicinity of the plants on which they have been feeding.

There are several methods of combatting these pests, the most effective usually being by the use of a poison bait. This is composed of bran, and paris green, mixed in the proportions of 50 lbs. of the former to 1 lb. of the latter. Only just sufficient water should be added to moisten it. It should be broadcasted among the plants at the rate of 10 lbs. dry weight to the acre. Care is necessary when using this bait.

Another method is to protect the young plants by placing a metal cylinder around each one. For this purpose a cigarette tin with the bottom removed is suitable.

Reference must now be made to those insects which feed by sucking the sap of plants in, causing them to wilt.

Two abundant species of sucking insects are the Coreid bugs *Physomerus grossipes* F. and *Acanthocoris scabrator* F. both of which occur from time to time in large numbers and as more than one life cycle may be spent on a plant, it is more than likely that it will not survive the combined attack of both larvae and adults. The eggs of *P. grossipes* which are small copper coloured ovate objects are laid side by side in batches containing up to about fifty.

Acanthocoris scabrator also lays eggs of a copper colour and ovate shape, which it arranges in a similar manner.

The eggs of both species are laid either on the undersides of leaves, on stems, or even on the supports to climbing plants, such as Ipomoea.

Although a considerable reduction in the numbers of these two species may be brought about by the collection and destruction of the eggs, a much more satisfactory manner is to spray the insects with kerosene emulsion, or with tuba solution.

Scale insects, do not appear to be pests of importance in Malaya; there is one species, however, *Saissetia nigra* which is sometimes very abundant, attacking principally *Hibiscus*.

Kerosene emulsion should be used against this insect, but it equally efficacious to crush the "scales" with the hand, a coarse glove being worn.

One more important pest, that is, the small ant *Solenopsis geminata*. The reason for this species being considered a major pest is that it is a robber of freshly sown seed from beds or boxes.

There are two ways of combatting this pest, one, by spraying the seedbeds with kerosene emulsion, or by trapping the ants by means of a bait. This consists of placing pieces of candlenut around the seed beds immediately after the seeds have been sown.

S. geminata is strongly attracted to this kind of bait, and when it is found that the pieces of candlenut are well covered by ants attracted to them, boiling water should be poured over them.

As a preventive measure, mixing the seeds with fine powdered naphthalene will repel this ant, or one can prepare seed beds by first covering the area in which it is proposed to sow the seed, with a layer of soil which has been previously mixed with kerosene, to a depth of a couple of inches and then to place on top of that, sufficient soil to take the seeds.

When mixing the soil with kerosene only just sufficient of the latter should be used, so that the soil remains friable after treatment. Another preventive measure which is recommended is to fit legs on to the seed boxes which then may be stood in tins containing water and disinfectant.

The insects I have referred to are those which will come to ones notice most frequently, but of course there are numerous other insects which are minor or occasional pests. It is impossible, however, to deal adequately with these in the short time at my disposal.

In the course of this paper I have referred to only one stomach poison, that is, lead arsenate, a substance which is comparatively cheap and has the

additional advantage of being practically non-scorching to foliage, since it contains only an infinitesimal quantity of soluble arsenic.

The proportions in which this should be used are 2-3 pounds of the poison in powder form mixed with 50 gallons of water. Lead arsenate is sometimes sold in the form of paste, therefore if this form is used, rather larger quantities are necessary.

It is important to bear in mind that when using a lead arsenate spray, it is necessary continually to agitate the spraying machine or, if the fluid is being applied with a syringe, it should be churned up from time to time by pumping it back on itself, since the lead arsenate will sink and form a thick sediment on the bottom of the receptacle if this is not done.

Lead arsenate solution has yet another thing in its favour, its property of sticking to a plant and remaining effective for some weeks provided it has had time to dry before rain has begun to fall.

A contact spray affects the respiratory system of insects by blocking up the spiracles or openings to the air tubes or tracheae. To be effective it is essential that the insect be thoroughly wetted by the fluid.

Among contact sprays may be mentioned nicotine, kerosene emulsion and extract of 'tuba' root. Of these three, kerosene emulsion, and 'tuba' root extract are the most popular and least expensive.

To prepare a solution of nicotine, 3—3½ oz. of 95/98% nicotine sulphate are mixed with 20 gallons of water. In order to increase the wetting properties of the solution 1—1½ lbs. of soft soap should be added to the mixture after being dissolved in 4—5 gallons of water.

The ingredients necessary for the preparation of kerosene emulsion are water, kerosene and soap, and if only fairly small quantities of the solution are required at a time, a convenient way of measuring them is to use cigarette tins which usually hold ½pt.

For the preparation of sufficient stock solution for use in an average sized garden, take 4 tins of water, 8 tins of kerosene and ½lb. soap. The soap should be dissolved in water while it is still boiling over a fire, and then when it is thoroughly dissolved, the receptacle should be removed from the fire and the kerosene poured in.

When it is required for spraying, one tin of this solution should be mixed with 7 tins of water, care being taken that the mixture is thoroughly churned or shaken up in order that a complete emulsion is obtained, otherwise there is the risk of scorching plants if the kerosene separates out.

The manufacture of a solution from tuba root is, no doubt well known to most gardeners, but it may not be out of place to describe the process by which one may obtain the greatest amount of extract from the root.

First of all, 2—4 lbs. of the root should be broken in small pieces and well pounded, and at the same time, a little water should be added. When the root has been reduced to a pulp, it should be soaked in water and then placed in a cloth which should be pressed until all the liquid is extracted. This extract is then mixed with 10 gallons of water.

Tuba solution is essentially a contact poison, but, statements have been made that it is also a stomach poison. Whether this is so, is doubtful. Experiments which have been carried out in the entomological laboratory of the Department of Agriculture seem to indicate that it has asphyxiant or repellant properties which may last for two or three days, provided the plant which has been sprayed is protected from rain.

Regarding the question of spraying apparatus, the Four Oaks Spraying Machine Company have put on the market what appears from their catalogue to be a satisfactory light sprayer, which is inexpensive, costing only 28/6d. and which would meet the requirements of all amateur gardeners.

The upkeep of spraying apparatus requires careful attention, and on all occasions, sprayers, syringes, should be thoroughly cleaned after use, by washing with clean water several times.

Generally, it will be found best to dismantle the syringe or sprayer after use, and not to reassemble the parts until they have been thoroughly cleaned and dried. On reassembling the parts one should make sure that any leather washers, and particularly the washer on the plunger of the pump, are well greased.

By exercising the utmost cleanliness, in respect of such apparatus, a longer lease of life will be given to it, than if neglected and not freed from any corroding substances.

I have dealt as far as possible with a few of the insect pests which trouble the gardener, from time to time. There are, of course, many other pests, such as snails, slugs and millepedes, which are not insects, and therefore do not come within the scope of this paper.

NEW OR INTERESTING ORNAMENTAL PLANTS.

The African Violet.

(Saintpaulia ionantha)

The African Violet is a native of East Africa where it is said to grow in rock crevices, both on granite and on limestone rock. It was first introduced to Europe about 1893 and was exhibited as a novelty at a number of flower-shows during the immediately succeeding years. Since that time it has become a fairly common hot-house plant in Europe. The name 'African Violet' is appropriate as the whole plant bears a superficial resemblance to the common violet. The leaves are heart-shaped, fleshy and covered with fine stiff hairs. When healthy they have a beautiful satiny sheen. The plant is rosette-shaped and compact, usually only two or three inches in height and six or eight inches in diameter. The flowers are not large, but are numerous on a strong plant, and they are well shown off by the surrounding leaves. They vary in colour from light blue to deep violet-purple and have as a contrast very bright yellow stamens. Unfortunately they lack scent.

The plant is sometimes called Cape Violet, but as its home is far from the Cape the name is not very suitable. The name Saintpaulia was given in honour of Baron Walter von Saint Paul, who first sent seeds to Europe.

The African Violet has been known in Malaya for some years and recently its cultivation seems to have spread as plants are now by no means uncommon. Good specimens may be seen in the Public Gardens at both Singapore and Kuala Lumpur. It makes a very charming and neat plant for a small pot, and, with a little attention is quite easy to grow well. A plant will flower continuously for some months, though, in the writer's experience the flowers decrease in number and diminish in size after a week or two in the house. This difficulty can easily be overcome by having a number of plants which can be successively brought indoors for a couple of weeks each. For those who possess a plant-house or shady rock-garden the plant is very useful. It thrives under much the same conditions as those suitable to Maidenhair ferns.

Cultivation.

The three essentials for successful growth of the plant are shade, moisture and perfect drainage. A little sunlight is by no means harmful but it should not be more intense or prolonged than maidenhair ferns can stand. For potting compost coarse sharp sand, small rough stones, finely broken brick or any such drainage mixed with a little leafmould or good soil seems adequate. The compost must be really 'open.' Its actual composition appears to be more or less immaterial as long as it drains well. The writer remembers seeing masses of African Violets growing on the benches of the orchid houses of Messrs. Cyphers of Cheltenham. These benches were covered with an inch or so of coarse clean gravel in which Saintpaulia seemed

Hymenatherum tenuilobum, natural size.

quite at home with no fine soil at all. Small amounts of artificial manure are beneficial but should be used sparingly.

Propagation.

The plant is most easily propagated by leaf cuttings. Mature outside leaves should be chosen and cut off with a long stem, using a sharp knife or old razor-blade (not scissors). It is important to avoid bruising the leaf-stem when cutting, and to have a really clean cut. Cut leaves should be laid nearly flat on the surface of sharp coarse sand or small stones. The coarse washings from the edge of a garden path answer well. The cut end of the stem should then be lightly covered with sand and made firm. The box or pot of cuttings should be shaded and kept moist (but not wet). Roots appear at the cut end of the stem in about ten days and small shoots in the same place after about five weeks. When large enough the small plants can be potted off or planted out. They should flower about five or six months after the cutting was taken from the parent plant.— B. A. LOWE.

Hymenatherum Tenuilobum.

(Texas Marigold)

This little plant, with its numerous bright yellow flowers and dainty foliage, promises to be very useful in Malayan gardens. It was introduced by seeds from the Agri-Horticultural Society of India (Calcutta) to the Botanic Gardens Singapore in 1930, wrongly named. It was at first thought to be a *Senecio*, but proves to be a *Hymenatherum*, very probably *H. tenuilobum*. There are about a dozen species of this genus (family Compositae) and all belong to the warmer parts of North and South America—Texas, Arizona, Mexico and Chili. *H. tenuilobum* comes from Texas, and there appears to be no record so far of its use as a garden plant in this part of the world. We suggest for it the name "Texas Marigold"; but there are other plants in Texas which might be so called.

It is a low much-branched herb, sometimes becoming woody at the base. The leaves are all divided into 7 to 11 fine, almost threadlike filaments, giving the plant a delicate feathery appearance. The flower-heads are borne erect above the leaves on very slender stalks up to about 4 inches in length. The bracts surrounding the flowerheads, which in many Composites are in several series and free from one another, are here in a single series and united into a narrow cup with about 12 short teeth. Below the teeth is a row of narrow pale brown glands. The "flower" of a Composite is, of course, actually a head of flowers, and these bracts are not a calyx, although they look very like one. Inside this calyx-like cup the minute flowers are densely packed. They are of two kinds—

(1) an outer row of about 10 to 13 ray-flowers which radiate outwards and form the conspicuous part of the flower-head, and

(2) the numerous disk-flowers, occupying the centre of the flower-head.

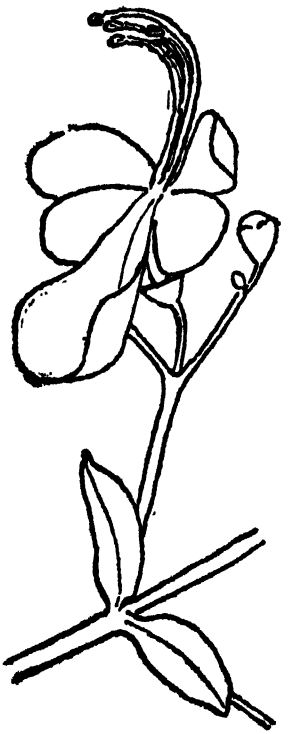
The heads measure about half an inch across, and both ray-and disk-flowers are bright yellow. The disk-flowers only bear fruits, which look like narrow black angled seeds with short pointed scales at the apex.

This plant is easily propagated from seed, which however, is rather sparingly formed, or from cuttings. It needs full sun, and is a useful addition to the garden as a low growing border plant, a small pot plant, or in the sun rockery. It behaves more or less as an annual, but remains in flower for a much longer period than most annuals in Malaya.

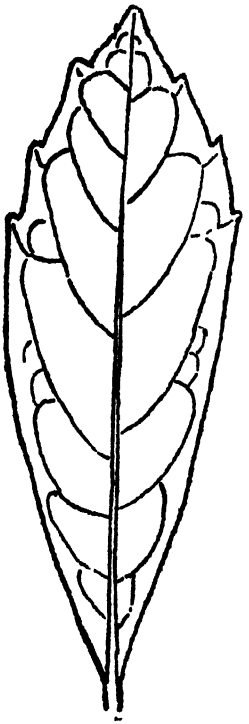
M. R. HENDERSON.

Clerodendron Ugandense.

This is one of the few blue flowered shrubs which can be grown successfully in Malaya. It was first described by Sir David Prain in 1909 from plants raised at Kew. The species is native in Uganda, where it was found growing at 2000 feet altitude. It was introduced to Singapore from Kew in 1925.



Clerodendron ugandense is a scrambling shrub, its stems being hardly strong enough to stand erect without support. It has narrow fresh green leaves, coarsely toothed, in opposite pairs. The flowers are in groups at the ends of the branches. The calyx is small and cup shaped. There are five petals, four pale blue, all about the same size, the fifth a much deeper blue, twice as long as the others. The group of stamens, with the style, curves away from the side of the flower opposite to the large petal. Each flower is about one inch across. Judging from the illustration prepared at Kew, the plants in Singapore do not flower as freely as they should; but they produce quite enough flowers to make them very attractive at times. The flowers are useful for cutting.



Our experience is that the plants do not like too exposed a situation, and they will grow and flower quite well under light shade or on the edge of a shrubbery or thicket. They must have good soil to grow well. We have lately tried grafting *C. ugandense* on the local species *C. serratum* (a stout shrub), and the result has been a vigorous growth of the scion. It is probable therefore that this method may be the best for local cultivation, at least in lowland situations. *C. ugandense* has yet to be tried at Malayan Hill Stations. So far as we have seen, this Clerodendron rarely produces a sufficient mass of flowers to make it suitable for pot culture. The plants produce good seeds in Singapore; they may also be propagated quite easily from cuttings.

R. E. Holttum.

Miscellaneous.

THE CONTROL OF RURAL MALARIA

BY

K. B. WILLIAMSON, M.A. & DIPLOMA AGRIC. (CANTAB), D.I.C.

(Formerly Malaria Research Officer F.M.S. and recently in charge of anti-malarial investigations Cameron Highlands).

(Continued from p. 201 Vol. III. No. 4 October 1933. The following section, held over from the last issue, completes the survey of the possibilities of mosquito--control by artificial methods, and will be followed by an account of natural methods, more suited for the control of Rural Malaria, one of which, namely the newly tried method of Herbage Cover is preliminarily described, in the hope that it may be given further extensive trial.)

Slowly Dissolving Mineral Poisons.

Mosquito larvae may be killed by many mineral substances and poisonous inorganic 'salts,' if these are dissolved in water. Older experiments made use of readily soluble salts, which brought about the death of larvae in a few hours. Most of these compounds, such as soluble cyanides and corrosive sublimate and readily soluble forms of arsenic, are extremely poisonous to men and animals. Although the possibility exists of using them in very weak solutions which might prove destructive to larvae and yet be harmless to fish and higher animals, the practical difficulty of regulating and maintaining the concentrations in continually varying volumes of water within the necessary limits, is insuperable. It was claimed for example that a concentration of 1 in 200,000 of cyanide of sodium might be used in wells. But he would be a brave man who drank their water, trusting that the equivalent of an oiling coolie had calculated the volume in each well and treated it with the calculated dose of cyanide. And the difficulty of measuring the volume of water and maintaining the proper concentration of poison in pools and ditches alternatively drying up, and flushed with rain, is much greater.

Must we conclude that mineral poisons are necessarily unserviceable? Let us, as in solving a problem in geometry, assume the thing done, and then work back to the conditions which enable us to do it. The ideal is evidently provided by a substance which is poisonous to mosquito larvae and harmless to higher animals in the concentrations required. We have such a substance in copper and its 'salts.' One condition of the problem is determined. But there remains the difficulty of regulating the concentration of copper. Must a Sanitary Inspector visit each pool for miles, plot its section, calculate the volume and add the required amount of copper in solution? And repeat the

operation every time there is a fall of rain? He would be a busy man. Copper sulphate is, as a matter of fact, commonly used in reservoirs, though less with a view to killing mosquito larvae than to preventing blockage of the exit pipes by growth of slime and algae. The exact amount needed has to be calculated so as to give a concentration of about one part in a million. The water-works' engineer is competent to do this; but great harm results if the proper concentration is exceeded, water plants and fish being killed and causing the water to be fouled by their putrid remains. If report is true, this happened some years ago in one of the Colony's lakes, where the supervisor towed a bag of bluestone behind a boat for a few hours, achieving all and more than he hoped for.

The solution of the problem, not alone for copper, is to use minerals or cheap commercial residues, which are technically though not absolutely insoluble, and which will automatically maintain a concentration sufficient to kill mosquito larvae within the period of a week or ten days through which they remain larvae. Pupae, owing to their hard horny covering, and to the fact that they do not feed, are only slowly killed even by strong concentrations of poisons.

The possible utilisation of little-soluble forms of copper, a preliminary account of which appeared in the Annual Report of the Malaria Advisory Board for 1932, is of particular interest. To take first the metal itself. It was first tested in a precautionary experiment made in England in 1921, the object of which was to ascertain whether copper gauze might be used without harmful effect upon larvae for periods up to three or four hours in an apparatus in which the effect of poisonous vapours was being tested. No harmful effect was observed within 16 hours. It was thereafter deemed safe to use cages made of brass gauze for experimental larvae to be placed in rice-fields, and a number of these cages was constructed in 1924. But tests showed that many of the anopheline larvae placed in these cages in the laboratory died in a few days, although they were placed in a fairly large volume of water; and muslim cages were used instead in the outdoor experiments. These trials, like the earlier experiments, were merely precautionary, and gave no certain assurance that metallic copper was fatal to larvae. The question has therefore been re-investigated with critical control experiments during the past two years, with the result that it has been found that all larvae of *A. maculatus* die within five days,—and with few exceptions, all within three days,—when copper or brass is present in the water: while in the most of the experiments none of the control larvae died. Similar results were obtained with various compounds of copper which are supposed to be insoluble, and their effect remained after months of washing in running water. On the other hand, little or no harm resulted to larvae kept in the presence of zinc, iron, or aluminium; and insoluble compounds of lead acted more slowly than those of copper. Minute traces of copper were detectable in the water by very delicate tests, metallic copper itself being slowly soluble. The

practical problem is to procure cheap ores or residues slightly more soluble than most of the compounds tested in the laboratory, and which will ensure that the minute traces of copper needed to safeguard breeding waters will be maintained in spite of rain and seepage flow; and a search for these is being made.

It may be remarked in passing that white arsenic, (arsenious oxide), when mixed in the proportion of five or ten per cent with cement, has a long lasting effect, causing the death of larvae in a few days, even when it has been washed for months in running water; but the danger in the use of a strong poison like arsenic without the most careful regulation of its concentration makes it a much less desirable substance than copper. The amount of the latter needed to exterminate mosquito larvae is less than could have any effect upon men or animals who drank the treated water by accident, and in stronger doses copper is a cure for the 'bloodless' condition known as anaemia, which follows malaria,—so that by medicating the water, it becomes both a preventive of malaria and a remedy for one of its ill effects. We may envisage a time when the anti-malarial coolie will be encouraged to take a course of the waters which it is his task to treat!

Slow mineralisation promises a possibility of effective control which may reduce the labour cost of treating pools and seepages to a fraction of what it now is, and, with very small expenditure on material, enable distant danger spots to be freed from risk for many months by a single treatment. In this way expert control, which is now limited by its lack of funds and trained workers, might reach out a long arm, embracing areas many times greater than are at present controlled. But the method is clearly inapplicable to rapidly running water, and its usefulness in ponds and marshes is doubtful. On the other hand, the coppering of containers in towns threatened with yellow fever might be an invaluable aid in fighting the disease if it ever appears in this country.

This short review of the artificial methods which science has placed at the disposal of those who wage war against the mosquito prompts the reflection that too few of its resources have been made use of; and force is added to this opinion when we consider that apart from allowing natural shade plants to grow over ravines, none of the natural methods, next to be considered, are in general use. It may be surmised that our knowledge of the resources of science and of nature are small compared with what they may be expected to become in the future; for the powers that lie around us are unknown until they are experienced, or are disentangled by the imagination from the commonly admitted forces which prevent their recognition. No one can say with what means these yet undiscovered powers of Nature may provide us for checkmating malaria and other diseases.

The question remains, "How far are artificial methods, elaborated by science, likely to prove useful in controlling rural malaria?" Evidently a very potent drug or immunising agent may prove so, and we await its advent with hope, but by no means with complete confidence. Smallpox is now the

only disease preventible by medical means on a wide scale, and until an equally powerful anti-malarial method is evident, no drug which merely cures malaria, and which has to be continuously administered, offers any prospect of eradicating it. Of the two classes of preventive measures against mosquitoes, it may be concluded that artificial ones, however effective they may become in the future, are less suited for dealing with rural malaria than the best among natural measures. They present the primary disadvantage that the transport of the material and apparatus needed to remote villages will always offer almost insuperable difficulties; to which the cost of their purchase and transport must be added; and the more powerful and refined the methods of control become, the greater will be the need for them to be carried out by skilled and highly trained operators. We must, suppose that when the resources of technical science come to be fully utilised, the range of its operations will be greatly extended, but not so greatly that the diminution of the plagues carried by mosquitoes can be effected all over the countryside except by making use of the materials available in it, both in Malaya and elsewhere. This country is far advanced both in the theoretical anticipation, and the experimental application, of natural methods of control; and it will be profiting itself, and benefitting the world at large by its example, if it makes them the instruments of widely extended malaria-control throughout the country.

Herbage Cover.

The best known and tested of these methods will be described in the continuation of this article, namely, fish-rearing, the rotting of vegetation, and sluicing; together with another natural method which may be specially mentioned here because it has only recently been tried, and is consequently know only to a few, while it deserves wide and general testing. This is the method of HERBAGE COVER. Its operation is simplicity itself. Shallow water up to a few inches deep is covered with plucked grass and herbage, or the leaves of trees from "belukar" or the jungle, with a few twigs intermixed so as to form a brushwood drain for running water. The herbage is well trampled under foot until it forms an almost solid wall a foot or more in height. The cover thus formed is long lasting, and, so far as observation has gone, it cannot be penetrated by egg-laying mosquitoes; it provides dense shade and, at least in stagnant water, sufficiently concentrated rotting to prevent the breeding of malarial species. While inapplicable to rapidly running streams or steep ravines which discharge strong flushes of storm water, very little dislocation of the herbage occurs in ordinary hillfoot or other drains, if their lower ends are provided with a double row of stakes to keep the solid mass of vegetation in position. Most of the storm water flows under it, and the remainder sometimes makes its way over the top.

The method is particularly effective for stagnant pools where the biochemical effects of the rotting vegetation are greatest, and in small seepages. Occasional renewal of the herbage, and the filling up of holes which form in it,

case of shallow pools, or drains with shelving sides, is that the cover should extend to a foot or eighteen inches beyond their sides, so as to protect the surrounding ground which becomes flooded in rainy weather. Drains of this kind occur in the gutters which extend for miles along the inner side of the Highlands road, and which provide numberless breeding places for *A. maculatus*. They have been effectively dealt with where the precautions mentioned have been adopted; and in one case where a hillfoot drain and a series of pools were covered over, a notable improvement was brought about in the health of an adjacent coolie line, too far distant for regular anti-malarial work to be carried out near it. It is therefore probable that by this simplest, speediest, and cheapest, of all anti-malarial measures, much of the malaria of the hills and hill valleys might be stamped out, if measures were taken to teach it to villagers, and to organise and stimulate their efforts in the manner suggested in the previous article.

It should be realised that although in this country we are faced with one of the most serious malaria problems in the world, the fact that our chief malaria carrier, *A. maculatus*, in nine cases out of ten breeds in extremely shallow water, makes it one of the easiest of all species to control, provided that its obscure breeding places have been discovered. No words can sufficiently emphasise the need for attracting and encouraging the most skilled larvae collectors, since without them all measures are futile, and serious sickness may arise from two or three small undiscovered pools. But the extremely shallow water in the seepages where *A. maculatus* is commonest may be altered beyond recognition and rendered unfit for it by very simple natural procedures. Therefore to limit effort to oiling, which is better suited for dealing with the malaria arising from ponds, marshes, and other large accumulations of water in other countries, is to disregard the help to be derived from local circumstances, and to fly in the face of reason and commonsense.

(To be continued.)

RAINFALL RECORDING.

A Note for the information of Estate Managers, Hospital Dressers, etc.

BY

GILBERT E. BROOKE, M.A., L.R.C.P., D.P.H., F.R.G.S., F.R.H.S.

The recording of rainfall is a matter of considerable interest and importance. The rainfall concerns very largely the growing of crops and agricultural interests generally. It also has to do with the breeding of mosquitoes, the humidity of the air, the water-supply, and thus concerns the public health most intimately. For these reasons estates keep records of their rainfall; many hospitals are supplied with gauges; and meteorological stations are instituted at important centres.

The site of the raingauge should be sufficiently clear of trees or houses to obviate any sheltering effects. A good working rule is, that the distance between the gauge and the nearest object, should be at least twice the height of that object.

The gauge should be fixed on level ground, and protected from injury or movement by some form of concrete or other supporting pedestal, so fixed that the rim of the gauge is not less than 12 or more than 18 inches above the ground level. This height is necessary in order to prevent water or mud splashing into the gauge. The height most favoured by the authorities is 12 inches, since the amount of rain collected is said to decrease if the height is more than this, owing to wind eddies set up by the gauge itself. This is not necessarily so, as can be experimentally proved, and as long as the height is not greater than 18 inches between the rim and the ground level, the recording should be substantially correct. Anything which decreases the effective area of the collecting funnel, will reduce the amount of rain recorded. Hence it is necessary:—

(a) that the top of the gauge be level; and

(b) that the rim of the funnel be truly circular

For this reason we must conform to a standard pattern, in order to obtain a general uniformity in our world-wide records.

Types of Raingauge

The usual British types are only two:—i.e. circular gauges of a diameter of either five or eight inches. The Meteorological Office have proved that the amount of rain measured in a gauge with a rim of five inches (12.5 c.m.) will not show a working variation from that received in a gauge which has a diameter of eight inches (20 c.m.). Either of these two are in official use; and they are of sufficient size to contain about eight inches of rain without overflow. I have seen old gauges in use with diameters of six inches, and of ten inches, but such should be discarded in favour of the standard types. In places where the rainfall is likely to be exceptionally heavy, a special type of gauge should be used—the best being one known as the "Bradford" gauge, which is a five inch instrument with a receiving capacity of about 18 inches of rain.

Instructions for Measuring.

The F.M.S. Official Instructions, dated 1925, direct that the rainfall should be measured and recorded at 6 a.m. and 6 p.m.

The Royal Meteorological Society directs that, in stations where single daily observations are made at 9 a.m., the rainfall for the preceding 24 hours should be measured at the hour of observation, and entered in the register to the previous day. If readings are taken both morning and evening, the morning measurement is recorded to the previous day, and the evening one, to the same day. The gauge should always be examined whether you think rain has fallen, or not. Small amounts of dew, and small amounts of cloud-fog moisture, may occasionally be found in the gauge. If measurable, they should be entered as ' rainfall.'

Most readings are now taken in millimetres (mm), but the old fashioned inch measurement is still much in use, and the approximate conversion of one to the other is not difficult. The Meteorological Office suggest, that for the conversion of millimetres to inches, you should multiply by four, and move the decimal point two places to the left. Conversely, to convert inches to millimetres, you should divide by four, and move the decimal point two places to the right. Rainfall should always be recorded to tenths of a millimetre, or to hundredths of an inch. A quantity too small to measure should be recorded as a "trace." If there is no rain, always specify "nil" in the record sheet, do not leave it merely blank.

Unless a Bradford gauge is in use, it may be necessary in the case of exceptionally heavy rain, to measure it in instalments which can be added together later.

The inside container, and the measuring glass, should always be kept perfectly clean; and punctuality in recording is most important.

It may be of interest to mention that the average rainfall in Scotland is 43.2 inches per annum; in Ireland, 38.6 inches; and in England and Wales, 37.4 inches. In Cumberland, and parts of Wales, the fall has been known to exceed 245 inches; and it has been as low as 9.29 inches at Margate in 1921.

In Singapore, the wettest year recorded in 60 years was 1913 with 135.92 inches; and the driest, 1877 when only 58.37 inches fell.

The wettest station in the world is generally allowed to be Cherra Poonjee, in Assam, where the annual fall has exceeded 551 inches; and a daily fall has reached 40.80 inches.

The Measuring Glass.

With each instrument a graduated measuring glass is supplied, to a capacity of ½ inch of rainwater. It is important to see that the proper gauge glass has been supplied, for ½ inch of rain will naturally give a much smaller volume of water in a 5-inch, than it does in an 8-inch gauge. On all decent glasses, a figure is engraved showing the size of the gauge for which it is intended to be used.

Occasionally the measuring glass may be mislaid or broken. In such a case, before a new one is obtained, it is always possible to use a graduated

ounce—or c.c.—measure from the nearest hospital. The area of a circle of 5 inches diameter is 19.64 square inches: one inch of rain will therefore be equivalent to a similar number of cubic inches of water, in such a gauge. And 19.64 cubic inches are equivalent to 324 c.c., or 11.4 fluid ounces. If therefore we measure 11.4 fluid ounces from the collecting glass of a five inch gauge, we know that it represents one inch of rain.

An 8-inch gauge has an area of 50.28 square inches, and one inch of rain will give approximately 29 fluid ounces, or 825 c.c.

The following table of reference will give an emergency reading for use in such circumstances, until a new measuring glass can be obtained.

Emergency Table for Estimating Rainfall when the Rain-Gauge Gauge-glass is mislaid or broken.

With a Five-inch Rain-Gauge		Approximate Equivalent Rainfall			With an Eight-inch Rain-Gauge	
Fluid ounce Measure	Cub. Centim. Measure	Inches		Millimetres	Fluid ounce Measure	Cub. Centim. Measure
M 30	1	0.004 Mark as:		0 1 "A trace"	1 dram	3.5
1 dr	3.5	0.01	Slight Precipitation	0.24	2 dr	8
1¼ dr	4	0.012		0.25	3 dr	10
1½ dr	5	0.016		0.41	4 dr	13.5
1¾ dr	6	0.018		0.45	4½ dr	15
2 dr	7	0.022		0.55	5 dr	18
2¼ dr	8	0.025		0.63	6 dr	20.5
2½ dr	9	0.028		0.7	6½ dr	23
2¾ dr	10	0.03		0.75	7 dr	25
3 dr	11	0.034		0.85	1 fl oz	28.4
3½ dr	13	0.04	If more than the above, it will be considered "A wet day"	1.0	9 dr	32
4 dr	14	0.044		1.1	10 dr	37
4¼ dr	15	0.048		1.2	11 dr	40
4½ dr	16.5	0.051		1.3	1½ fl oz	42
5 dr	18	0.056		1.4	13 dr	46
5¾ dr	20	0.061		1.5	14 dr	50
6 dr	21	0.065		1.6	15 dr	53
6½ dr	23	0.07		1.8	2 fl oz	56.5
7 dr	24	0.075		1.9	17 dr	60
1 fl oz	28.4	0.087		2.0	2½ fl oz	71.5
8½ dr	30	0.098		2.4	22 dr	80
9 dr	33	0.1		2.5	23 dr	84
1¼ fl oz	35	0.105		2.6	3 fl oz	90

With a Five-inch Rain-Gauge		Approximate Equivalent Rainfall		With an Eight-inch Rain-Gauge	
Fluid ounce Measure	Cub. Centim. Measure	Inches	Millimetres	Fluid ounce Measure	Cub. Centim. Measure
10½ fl oz	39	0.12	3.0	3½ fl oz	99
11 dr	40	0.125	3.1	3¾ fl oz	100
1½ fl oz	42.5	0.13	3.3	4 fl oz	106
2 fl oz	56	0.17	4.4	5 fl oz	137
17 dr	60	0.18	4.6	5¼ fl oz	150
2¼ fl oz	65	0.2	5.0	5½ fl oz	168
2½ fl oz	71	0.22	5.5	6 fl oz	184
2¾ fl oz	80	0.24	6.0	7 fl oz	200
3 fl oz	85	0.26	6.6	8 fl oz	212
3¼ fl oz	95	0.3	7.6	9 fl oz	240
3½ fl oz	100	0.31	7.7	9½ fl oz	250
4 fl oz	112	0.35	9.0	10 fl oz	280
4¼ fl oz	119	0.37	9.2	10½ fl oz	300
4½ fl oz	126	0.39	9.5	11 fl oz	325
4¾ oz	133	0.40	10.0	12 oz	330
5 oz	140	0.44	11.0	13 oz	350
5½ fl oz	150	0.49	12.3	14 fl oz	400
5¾ fl oz	159	0.50	12.7	15 fl oz	425
6 fl oz	168	0.53	13.2	16 fl oz	437
6¼ fl oz	175	0.55	13.8	16½ fl oz	450
6½ fl oz	182	0.57	14.3	17 fl oz	475
53 dr	188	0.60	15.2	18 fl oz	490
6¾ fl oz	190	0.61	15.3	18½ fl oz	500
7 fl oz	196	0.62	15.4	19 fl oz	510
7¼ fl oz	200	0.63	15.5	19¼ fl oz	520
7½ fl oz	208	0.66	16.5	19½ fl oz	545
7¾ fl oz	210	0.67	17.0	19¾ fl oz	550
8 fl oz	224	0.70	17.8	1 pint	575
8¼ fl oz	230	0.74	18.5	21 fl oz	600
8½ fl oz	238	0.75	19.0	22 fl oz	625
9 fl oz	250	0.80	20.0	23½ fl oz	650
9½ fl oz	262	0.84	21.0	24¾ fl oz	675
10 fl oz	275	0.86	21.5	26 fl oz	700
10½ fl oz	287	0.90	22.9	27 fl oz	750
11 fl oz	300	0.98	24.5	28 fl oz	800
11¼ fl oz	307	1 00	25.4	29 fl oz	825
11½ fl oz	325	1.05	26.5	30 fl oz	850

With a Five-inch Rain-Gauge		Approximate Equivalent Rainfall		With an Eight-inch Rain-Gauge	
Fluid ounce Measure	Cub. Centim. Measure	Inches	Millimetres	Fluid ounce Measure	Cub. Centim. Measure
12 fl oz	350	1.10	27.6	33 fl oz	900
13 oz	375	1.17	29.0	35 oz	950
14 oz	400	1.23	31.0	37 oz	1 litre
15 fl oz	450	1.39	34.9	2 pints (1 quart)	1146
17½ fl oz	500	1.50	38.1	45 fl oz	1315
1 pint	550	1.76	44.1	2½ pints	1400
21 fl oz	600	1.86	46.6	55 fl oz	1½ litre
23 fl oz	650	2.00	50.8	3 pints	1700
25 fl oz	700	2.17	54.4	70 fl oz	1800
28 fl oz	800	2.48	62.2	75 fl oz	2 litres
30 fl oz	850	2.50	63.5	77 fl oz	2010
32 fl oz	900	2.78	69.7	4 pints	2200
25 fl oz	1 litre	3.00	76.2	90 fl oz	2500
2 pints (=1 quart)	1100	3.25	87.8	5 pints	2750
45 fl oz	1200	3.50	88.9	110 fl oz	3 litres
47 fl oz	1290	3.75	95.2	120 fl oz	3250
2½ pints	1375	4.00	101.6	130 fl oz	3500
54 fl oz	1445	4.25	107.9	135 fl oz	3700
55½ fl oz	1510	4.50	114.3	140 fl oz	3800
57 fl oz	1580	4.75	120.6	145 fl oz	3900
3 pints	1650	5.00	127.0	150 fl oz	4 litres
3¼ pints	1790	5.25	133.3	155 fl oz	4250
67 fl oz	1895	5.50	139.7	1 gal (=8 pints)	4500
3½ pints	2 litres	5.75	146 0	175 fl oz	4700
72 fl oz	2040	6.00	152.4	180 fl oz	4900
75 fl oz	2080	6.25	158.7	185 fl oz	5 litres
77 fl oz	2120	6.50	165.1	192 fl oz	5200
78½ oz	2160	6.75	171.4	200 oz	5400
4 pints	2200	7.00	177.8	207 oz	5600
82 fl oz	2240	7.25	184.1	215 fl oz	5800
85 fl oz	2280	7.5	190.5	220 fl oz	6 litres
87½ fl oz	2320	7.75	196.8	225 fl oz	6200
4½ pints	2360	8.00	203.2	240 fl oz	6400
95 fl oz	2440	8.50	215.9	250 fl oz	6800
97 fl oz	2480	8.75	222.2	260 fl oz	7 litres

With a Five-inch Rain-Gauge		Approximate Equivalent Rainfall		With an Eight-inch Rain-Gauge	
Fluid ounce Measure	Cub. Centim. Measure	Inches	Millimetres	Fluid ounce Measure	Cub. Centim. Measure
5 pints (=100 oz)	2750	8.80	225.0		
105 fl oz	3 litres	9.25	232.0		
5½ pints	3166	9.70	243.4		
115 fl oz	3272	10.15	254.7		
6 pints	3500	10.60	266.0		
125 fl oz	3625	11.00	277.0		
6½ pints	3750	11.50	288.0		
135 fl oz	3775	11.90	298.5		
137 fl oz	4 litres	12.00	305.0		
7 pints	4110	12.33	309.4		
145 fl oz	4220	12.77	320.4		
147 fl oz	4330	13.00	330.2		
7½ pints	4440	13.22	331.8		
155 fl oz	4550	13.66	342.8		
1 gal (=8 pints)	4700	14.10	355.8		
165 fl oz	4850	14.54	364.9		
8½ pints	5 litres	15.00	375.9		
175 fl oz	5100	15.42	387.0		
9 pints (=180 oz)	5200	15.86	398.0		
182 fl oz	5300	16.00	406.4		
185 fl oz	5400	16.30	409.0		
188 fl oz	5500	16.50	414.0		
9½ pints	5560	16.75	420.0		
192 fl oz	5625	17.00	432.0		
195 fl oz	5685	17.18	432.2		
198 fl oz	5740	17.50	439.2		
10 pints	5800	17.62	442.2		
204 fl oz	5865	17.75	445.4		
209 fl oz	5925	18.00	457.2		
210 fl oz	6 litres	18.06	458.0		

These high-capacity records are used for a Five-inch "Bradford Gauge" which has a capacity for 18"

MILK PRODUCTION IN THE TROPICS AND THE VALUE OF PASTEURIZATION

BY

T. D. MARSH, N.D.A.

Assistant Agriculturist.

In temperate climates where it is possible with the use of the ordinary water supply at most times of the year to cool milk to a temperature of about 50°F., the production of "Grade A" and more so "Certified Milk" necessitates the utmost care in maintaining a high degree of cleanliness in cattle management, milking and the handling of the product until it is delivered to the customer.

The production of high grade milk in Malaya is a much more difficult proposition owing to the prevailing high temperature, the mean maximum being about 91°F. and the mean minimum about 70°F. Such temperatures provide optimum conditions for bacterial growth in milk and with well and tap water at temperatures over 80°F. it follows that, in the absence of refrigerating plant, it is impossible on the plains to cool the milk immediately it is drawn from the cow. The small Indian dairyman, who merely milks his cows and sells the milk, has no conception of the bacterial activity that takes place in his product or even its possibilities as an agent in the transmission of human diseases.

Milk standards in force in Great Britain under the Ministry of Health are given hereunder[1]. They show the extreme care that is taken in Great Britain to ensure that branded milk is a high grade product; every assistance and encouragement is given to producers to raise the quality of their milk.

Certified Milk.

"A. **Producers only.**

1. (a) Examination of all animals in the herd by a veterinary surgeon once in every three months.
   (b) Application of tuberculin test to all animals at intervals of six months.
   (c) No animal to be admitted to the herd unless tested by tuberculin within the three months prior to admission.
   (d) Any animal showing evidence of disease likely to affect the milk injuriously or reacting to the tuberculin test shall be removed from or shall not be added to the herd.
   (e) All animals in the herd shall have identification marks, and a register of such animals shall be kept.
   (f) The herd must be isolated from all other cattle.
2. The milk must be bottled on the farm immediately after production.

(1) Extract from 'A Synopsis of Hygiene" by W. Wilson Jameson, M.A. M.D. (Aberd.) and F. T. Marchant, M.R. San. Inst. etc. Second Edition, 1927, pp. 116-117.

3. Every bottle shall be closed with a disc and covered with a cap overlapping the lip of the bottle and fastened so as to form a complete seal. The cap shall bear the name and address of the producer, the day of production and the words "certified milk," but, except with the consent of the licensing authority, no other words.

B. All Holders of Licences.

1. The milk must be delivered to customers in the original bottles with the seals unbroken.

2. At any time before delivery to the consumer the milk shall be found not to contain :—.

(a) More than 30,000 bacteria per cubic centimetre, and

(b) Any B. coli in one-tenth of a cubic centimetre.

3. The milk shall not at any stage be treated by heat.

Grade "A" Milk.

A. Producers only.

1. Every animal in the herd must be examined once in every three months by a veterinary surgeon.

2. Any animal showing evidence of disease likely to affect the milk injuriously must be removed from the herd and, if tubercle bacilli are found at any time in the milk, steps must be taken to ascertain which animals are diseased and to remove them.

3. All animals in the herd shall bear identification marks and a register of such animals must be kept.

4. The herd must be kept separate from all other cattle.

5. Except where the milk is bottled by the producer, the milk must be consigned from the dairy where it is produced in an unventilated sealed container labelled with the address of the dairy, the day of production (with the word "morning" or "evening" according to the time of milking), and the words "Grade A Milk."

B. Persons other than Producers.

1. Except where the milk is delivered to the consumer in the original containers with the seals unbroken, it must be delivered either in bottles or in other suitable containers of a capacity not less than two gallons.

2. Every bottle shall be closed with a disc and covered with a cap overlapping the lip of the bottle and fastened so as to form a complete seal. The cap shall bear the name of the dealer by whom the milk was bottled, the address of the licensed bottling establishment, and the words "Grade A milk," and the day of production. Containers other than bottles must be closed with tightly-fitting covers, and be suitably sealed and labelled.

C. All Holders of Licences.

1. At any time before delivery to the consumer the milk shall be found not to contain:—

(a) More than 200,000 bacteria per cubic centimetre, nor

(b) Any B. coli in one-hundredth of a cubic centimetre.

2. The milk shall not at any stage be treated by heat unless a licence to sell such milk as "Pasteurized" has been granted, and then the milk must be labelled "Grade A milk," pasteurized."

Grade "A" (Tuberculin Tested) Milk.

Here the same conditions must be complied with as in the case of Grade A milk with the addition, in the case of producers, of the conditions as set out in paragraph A (1) under Certified Milk. This milk must not at any stage be treated by heat.

Pasteurized Milk.

1. The milk must be retained at a temperature of not less than 145° and not more than 150°F. for at least half an hour, and must be immediately cooled to not more than 55°F.

2. The milk shall not be so heated more than once, and shall not be otherwise treated by heat.

3. The type of apparatus used for pasteurizing and the methods employed shall be such as are satisfactory to the licensing authority.

4. Every vessel containing the milk shall be labelled "Pasteurized Milk."

5. After pasteurization and before delivery to the consumer the milk shall be found to contain not more than 100,000 bacteria per cubic centimetre."

Milk sold under the above classifications usually commands a higher price than the ordinary ungraded bulk supply and the progressive dairyman endeavours to turn out the higher grade product.

It may be observed that the standards demanded are very high. Milk being a perfect medium at ordinary atmospheric temperatures for growth of bacteria the greatest care is required to market a product that is fit to be consumed in the raw state, and, even with all the above precautions, it is not possible to guarantee that milk will always be delivered to the customer free from pathogenic bacteria.

Production of Milk in the Tropics.

The production of high grade milk in the tropics presents a much more difficult problem, owing to greater bacterial activity than is the case in countries with a lower atmospheric temperature. Yet, at the Government Dairies at Serdang and Fraser's Hill, high grade milk is regularly produced by Tamil labour working under close supervision. Hygenic methods are adopted, including steam sterilization of bottles and utensils and the rapid cooling of the commodity immediately it is drawn from the cow.

Samples examined monthly show that the milk delivered to the hospitals and the public can invariably be classed as "Certified" or "Grade A".

To ensure as far as possible that pathogenic bacteria are not present in the milk, all persons associated with the production of milk by these dairies are tested by the Government Health Officers to ensure they are in a normal state of health and are not "carriers" of Diptheria or Enteric.

Malayan cattle are practically free from tuberculosis. European cattle imported by the Department of Agriculture were tuberculin tested and guaranteed free from this disease before they were shipped to Malaya.

Milk Produced by Indian Dairymen.

The small Indian dairyman is handicapped by the lack of facilities for cooling and the steam sterilization of utensils. His milk receptacles always contain sufficient micro organisms to give a rapid start to bacterial activity, since the milk, from the time it is drawn until delivered to the customer, remains at an ideal temperature for their rapid development.

Cows or buffaloes owned by Indians are mostly housed in temporary sheds of round jungle timber with attap roofs†, earth floors and drains; such sheds are impossible to maintain in a state of cleanliness sufficiently high to enable the owner to produce clean milk. Even if the average dairyman possessed the requisite knowledge of the degree of cleanliness required for his business, the lack of facilities preclude him from producing a product with a low bacterial count. In addition, he often has a water supply which falls below the standard of purity required, and which is often used to adulterate the milk.

In temperate climates, with dense populations, the education of dairymen in modern approved methods has been, for decades past, one of the most vigorous campaigns carried out by trained agriculturists and health authorities, whereas the average Indian cow keeper literally knows nothing of the degree of cleanliness necessary in handling milk.

To support these statements, the Health Officer, Kuala Lumpur, in his annual report for 1932, stated that most of the milk sold in Kuala Lumpur by Indian dairymen was filthy and bacterial counts of samples taken in the streets whilst the milk was being delivered, showed counts of between two and five million bacteria per cubic centimetre. It follows that milk produced by these people under such conditions must be extremely liable to carry disease gems, and risky to consume in the raw state.

The universal practice of boiling milk before consumption is the only known means the consumer has of safeguarding himself and his family against possible diseases carried in the milk and of rendering the milk safe to consume. Unfortunately such heat treatment, which is often sustained for much longer periods than is necessary, destroys the valuable enzymes and most of the vitamins in the milk. It also causes a proportion of the albumen and mineral salts to be precipitated. In this respect it is considered that one of the greatest merits of milk feeding lies in the easily assimilable form of the calcium contained in the mineral matter. It is probable that the metabolism of calcium is facilitated by the presence in the milk of the anti-rachitic Vitamin D.

From the foregoing it appears that it is practically impossible for the small native cow keepers to market a raw, clean, and safe supply of milk and,

† palm leaf thatch.

whilst such dairymen need education in the elementary methods of cleanliness, the public require protection and knowledge of a method of treating the commodity which will not destroy its vital properties or impair its digestibility, yet will make it a wholesome food free from disease germs.

Pasteurization of Milk.

It has been found that it is only necessary to heat milk to comparatively low temperatures and maintain such temperatures for a short length of time, to destroy all disease germs. This process is known as pasteurization and consists of heating milk to a temperature between 145° and 150°F., holding the milk at this temperature for 30 minutes and afterwards rapidly cooling. Another method is to heat to a temperature of 176°F. and cool immediately.

Cooling milk in tropical dairies accounts for a large proportion of the capital outlay and operating costs and involves the installation of a refrigerating plant.

These methods of pasteurization have been modified in the Military Dairies in India[2] to reduce the operating costs by eliminating the cooling process.

A system of pasteurization have been adopted, in which the milk on its receipt at up-to-date pasteurization depots, is immediately heated to 145°F. and held at this temperature for 30 minutes, after which it is bottled and sealed without reinfection and sold to the public whilst still hot.

With two deliveries per day and the rapid consumption of milk in hospitals or households, this method has proved to be highly satisfactory. The milk can be guaranteed to be safe, i.e. free from pathogenic organisms and to have, on delivery, a very low bacterial count. Such milk, unless stored in a refrigerator or ice chest, will not keep for many hours, as the prevailing temperature of the atmosphere to which that of the milk will gradually fall, will provide a perfect medium for secondary development of micro organism. There would, however, be no necessity to boil it on delivery.

It might be added that, during pasteurization, no undesirable changes in the composition of the milk take place, such as serious alteration of the taste, destruction of the enzymes, partial coagulation of the albumen, or precipitation of the calcium salts. Actually, pasteurized cows' milk is more digestible than raw milk owing to a slight change in the casein which, on coagulation in the stomach, is more finely divided than that produced from raw cows' milk.

From the foregoing it is not inferred that pasteurization is the means of eliminating all effects of the dirty habits of cow-keepers in their business of milk production and no one wishes to consume even sterilized filth.

Cleanliness or the absence of it in dairy practice is indicated by the bacterial count in the raw milk produced and, whilst pasteurization will provide a safe food for consumption, it is vitally essential that every care be taken in the production of a clean product.

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(2) Pasteurizing of Milk without cooling in India, Capt. C. E. Macginkin, Animal Husbandry & Dairying in India, Vol. III, Part 3.

The Malayan Agri-Horticultural Association.

Eleventh Malayan Exhibition.

It has been decided to alter the date of this year's Malayan Exhibition and it will be held on Saturday, Sunday and Monday, June 2nd, 3rd and 4th, 1934, the Monday being a Public Holiday in honour of H. M. the King's Birthday.

The Exhibition will as usual comprise competitive sections for Agriculture, Oils and Fats, Preserves and Confectionery, Horticulture, Poultry, Cats, Weaving & Needlecraft, Malay Schools, Village Industries, Art and Photography and Pigs. Schedules have been revised and are in course of preparation. They will be available together with entrance forms and labels on application to the Secretary, The Malayan Agri-Horticultural Association, 12 Barrack Road, Kuala Lumpur.

Last year the total floor area was considerably larger than in former years and it is confidently anticipated that the Eleventh Exhibition will be the biggest yet so that even the extensive Association grounds will be filled to capacity.

There are definite indications that the Trade Section will require increased space, reservations having already been made and several business houses who were too late to enter last year, have expressed their intention of exhibiting this year.

It is hoped to arrange an attractive series of amusements and fuller particulars will be given in our April notes.

Malayan Hampers.

Brief reference was made in the October issue of this Magazine to the scheme developed by the Association for the delivery in Great Britain and Ireland of Christmas Hampers containing produce of Malaya only.

We are glad to report that the Scheme met with considerable success, a total of 108 hampers being dispatched on the 17th November and due to arrive in London on the 17th December, thus giving ample time for delivery before Christmas.

The hampers contained the following long list of products: tea, coffee, tinned pineapples, seed pearl and medium pearl tapioca, rice, pepper, cloves, nutmegs, mace, candied lemon, chutney, jam, Port Dickson bag, a Kelantan sarong and Malayan pewter.

Criticism was made of the inclusion of tapioca as being dull and an unfortunate reminder of childhood days. It was probably not realised that the actual monetary value of the tapioca was small but it was included to show the variety of Malaya's agricultural resources and when it is remem-

bered that the annual exports of tapioca products average 30,000 tons of a value of $2,000,000.00 even at present low market prices, it will be seen that its importance is considerable.

Several people also were apparently unaware that Brazil nuts grow in a large nut or pod which was actually what was sent in the hamper and rated the Association unduly mean in offering one nut only!

Time was lacking in which to make the scheme as comprehensive as desirable and several suggestions were received after circulars had been printed and issued.

It is anticipated however that the scheme will be put into operation again for next Christmas and that alternative hampers will be available covering a wider range of Malayan products.

Malayan Padi Competition.

In connection with the Eleventh Malayan Exhibition, which, as above announced, will be held in Kuala Lumpur on June 2nd, 3rd and 4th, a special feature will be the Malayan Padi Competition which is being organised by the Association in conjunction with the Department of Agriculture and which was referred to briefly in the July issue of the *M.A.H.A. Magazine.*

The padi classes have always formed an important section at the annual Exhibition and have done much to stimulate interest in padi planting and to encourage the use of high yielding strains.

Exhibits in these classes have hitherto been exceptionally numerous, running into thousands, but have been small in quantity, one quart each, and without any attendant information regarding the size of the holding or the yield obtained. It had been felt for some time, therefore, that this method of competition was unsatisfactory and the Director of Agriculture drew attention to the position in a memorandum to the Committee of the Association outlining a scheme for the development of an All Malayan Padi Competition culminating in the Annual Exhibition at Kuala Lumpur.

Briefly, the scheme provided for Local Competitions to be held in each District, either in conjunction with District Agricultural Shows or as special padi shows. The prize winning exhibits in such local competitions would be collected and forwarded for entrance in the Central Competition at the Malayan Exhibition.

These proposals were submitted to the Agricultural Conference held in August, 1933, and were strongly supported by a Committee of the Conference appointed to consider the scheme. The scheme was also considered and accepted by the Committee of the Malayan Agri-Horticultural Association and by them was submitted to the Governments of the Straits Settlements, the Federated Malay States and each of the Unfederated States. These Governments were asked if they approved the general outlines of the

scheme and would be prepared to put it into operation after the coming padi harvest. The replies received were on the whole favourable.

Rules for this competition are printed below. They provide for larger exhibits (3 gantangs) to be accompanied by a statement of the area in which the padi was cultivated and a certificate of the yield obtained, given by the Penghulu, and require, in addition, a certificate from the Agricultural Field Officer stating the average yield of padi for the whole of a particular district.

The Malayan Agri-Horticultural Association has offered Bronze Medals for the first prizes at the Local Shows and the Department of Agriculture is prepared to provide diplomas and certificates.

Rules.

1. The Malayan Padi Competition shall be organised in two parts—
   Part I — The Local Competitions.
   Part II — The Central Competition at the Association's Annual Exhibition in Kuala Lumpur.

Part I. Local Competitions.

2. Each Local Competition shall be organised jointly by the District Officer and the Agricultural Field Officer of the Circle, State or Settlement in which the District is situated.

Entries.

3. Each intending competitor shall notify the District Officer or his representative, for example the Penghulu of his Mukim, of his intention to enter for the competition not later than a date to be notified by the District Officer.

4. Before the commencement of the competition the Agricultural Field Officer for the Circle, State or Settlement shall furnish the District Officer with a list of strains of padi approved for entry in the competition. No padi will be accepted for entry unless it is of one of the approved strains.

5. Each exhibit entered for the competition shall be taken from an area of not less than ½ acre planted with the particular strain exhibited.

6. Each exhibit shall consist of 3 gantangs of padi and shall be delivered at the place appointed for the Local Padi Show on the date fixed by the District Officer for the receipt of exhibits.

7. Each exhibit must be accompanied by an entry form to be obtained either from the District Officer, the Agricultural Field Officer for the Circle, State or Settlement, the Penghulu of the Mukim, the Malay Agricultural Assistant, or the Malay Agricultural Subordinate for the District or locality.

8. On the entry form shall be shown—
   (i) The name of the competitor.
   (ii) The locality of the holding and if possible the lot number.
   (iii) The size of the area from which the padi entered for competition was drawn.
   (iv) The strain of padi entered.

(v) The yield of padi in gantangs harvested from the area under (iii).

9. Each entry form shall bear a certificate signed by the Penghulu of the Mukim or a Malay Agricultural Assistant or Subordinate to the effect that the statements made on the entry form in accordance with Rule 8 are correct and also a statement of the average yield of padi in gantangs per acre, relong or orlong for the mukim so officially determined.

Time and Place of Local Show.

10. The Local Show shall be held at such time and place as the District Officer may arrange.

Appointment of Judges.

11. Exhibits shall be judged by judges appointed by the District Officer.

Judging Exhibits.

12. In judging exhibits the data set out on each certified entry form shall be taken into consideration in addition to the merits of the actual sample to which it refers.

Prizes.

13. In each local competition prizes shall be awarded to the three best exhibits, but the judges shall at their discretion be entitled to award additional prizes and certificates.

Disposal of Exhibits.

14. At the conclusion of each Local or District Show the prize winning exhibits together with certified entry forms relating thereto will be retained by the Agricultural Field Officer of the Circle, State or Settlement for despatch to the Association's Annual Exhibition in Kuala Lumpur. Such exhibits so retained will be paid for by the Association at three cents per gantang above the standard market price for padi in the District or locality and will become the property of the Association. All other exhibits will be handed back to their owners or disposed of as the owners may direct at the conclusion of the local show.

Part II. Central Competition.

15. On a date to be fixed by the Malayan Agri-Horticultural Association each Agricultural Field Officer shall despatch to Kuala Lumpur at the expense of the Association all winning exhibits collected from the District competitions in his Circle, State or Settlement, together with the certified entry forms in respect thereof. He shall not state what prize was awarded to each exhibit in the Local Competitions and shall see that the entry forms do not convey this information.

16. These exhibits shall be displayed in the section devoted to padi at the Association's Annual Exhibition in Kuala Lumpur. The assembled exhibits shall be judged in accordance with the standards of the Association, but there shall also be taken into account the particulars furnished on the certified entry forms.

17. The Judges for the Padi Section shall be appointed by the Association.

18. Prizes shall be as follows—

First Prize	—	A Diploma of Merit, the sum of $25/-, a Gold Medal, and a Challenge Trophy to be retained by the winner until the competition in the ensuing year.
Second Prize	—	A Diploma of Merit, the sum of $10/-, and a large Silver Medal.
Third Prize	—	A Diploma of Merit, the sum of $5/-, and a Silver Medal.
Fourth Prize	—	A Diploma of Merit, and a large Bronze Medal.
Fifth Prize	—	A Diploma of Merit, and a Bronze Medal.
Sixth Prize	—	A Diploma of Merit.

The judges shall be empowered to award additional prizes and certificates of merit at their discretion.

Malayan Hampers.

As we go to press we are given permission to quote the following appreciation of a Malayan Hamper from its recipient.

"That was a wonderful box you sent me—most fascinating. I am sending some of the items on to relations."

Selangor Gardening Society.

Meetings.

A meeting was held at the Lake Gardens' Potting Shed on December 12, 1933 when Mr. E. J. McNaughton gave a lecture on " Care and Treatment of Ornamental Lawns and Playing Fields." The lecturer dealt first of all with the principles underlying the production and management of a good sward, and then discussed in detail the more important problems which confront the professional or amateur greenkeeper in this country. The subject matter was handled in a very attractive manner, and members will doubtless be glad to hear that Mr. McNaughton has consented to favour us with another lecture in the near future. It is hoped to publish Mr. McNaughton's lecture in the next issue of the *M.A.H.A. Magazine*.

Flower Show.

As in former years there will be two Flower Shows during 1934. The first of these will be held at the Racecourse, Kuala Lumpur, on Saturday, February 17, by kind permission of the Selangor Turf Club.

All classes will be open to non-members, and a recent amendment of the show rules enables professional horticulturists to compete on equal terms with amateurs. Two new classes have been introduced, one for miniature gardens, and one for hill-grown cut flowers. In the former class there is no limit to the size or type of exhibit, and either cut or growing plants may be used, together with ornaments of stone, wood, etc., if desired. This class should provide scope for originality in staging, and for the use of those humbler types of garden plants which cannot be exhibited in other sections of the show.

Copies of the Show Rules and Schedule of Classes can be obtained from the Hon. Secretary, Mrs. R. P. N. Napper, 186, Ampang Road, Kuala Lumpur.

M. E. N.

District Agricultural Shows.

1933 was a year remarkable for the number of District Shows held throughout Malaya, no less than four being held in Selangor in October and November. Space prohibits more than the following brief reports of the latter Shows.

Ulu Langat.

The second annual Ulu Langat District Agricultural Show was held at the Government Office, Kajang on Sunday October 1st. 1933.

The show was formally opened by the Hon'ble the British Resident, Selangor in the presence of a number of Government Officials from the Agricultural and Co-operative Departments and a large gathering of local Malays. The Director of Agriculture, the Chief Field Officer and the Assistant Director of Co-operation were among those present.

There were eight competitive sections for Padi, Fruits, Vegetables, Minor Economic crops, Poultry and Home Industries. Most of these were well supported while the actual exhibits reached a fairly high standard. The best sections were those devoted to padi, vegetables grown by Chinese Market gardeners and poultry.

Besides the competitive classes, special exhibits were shown by the Yu Hwa School of Manual Arts, the 8th. Troop of Boy Scouts and by the Department of Agriculture.

During the day a Badminton tournament was held, a lecture on poultry keeping was given by Mr. W. H. Barnes and in the evening, cinema films belonging to the Agricultural and Co-operative Departments were shown.

The show was not only a success from an agricultural point of view but also provided a very enjoyable day for the local inhabitants.

Kuala Selangor.

The second annual Kuala Selangor District Agriculture Show was held at the District Office, Kuala Selangor on Tuesday, October, 17th. 1933. The Show was opened by H. H. the Sultan of Selangor in the presence of the Hon'ble the British Resident, Selangor, the Directors of Agriculture and Co-operation, the District Officers, Kuala Selangor, Klang, Ulu Langat and Kuala Langat, a number of Government Officials from the Agricultural, Co-operative and Health Departments and a large gathering of Malays from all parts of the district.

There were thirteen competitive sections providing classes for Padi, Minor Economic crops, Fruits, Vegetables, Oils and Fats, Rubber, Poultry and Home Industries. The outstanding sections were those devoted to Vegetables, Oils and Fats, Poultry and Mats made from Mengkuang and Pandan—but while in the remaining sections, a small number of exhibits were received, many of them were of excellent quality.

Besides the competitive sections special exhibits were put up by the Health, Co-operative Societies and Agricultural Departments.

In the afternoon a boat race for the Chinese ferrymen and a football match were arranged and attracted a large and enthusiastic crowd.

In the evening a film prepared by the Health Department was shown, followed by a lantern lecture on ' Copra ' and then by further films belonging to the Agricultural and Co-operative Departments.

The show was extremely successful and even improved on the very high standard set in the previous year. This was mainly due to excellent organisation and attention to the lessons of the previous show.

Sabak Bernam.

An extremely successful sub-district Agricultural Show was held at Sabak Bernam on Sunday November 12th. 1933. This show, the first ever held in that sub-district, was organised and financed entirely by the local inhabitants, who undoubtedly, were inspired by the success of the Kuala Selangor Show. That such a successful show could be organised in these hard times, without financial support from Government, was due entirely to the efforts of the Assistant District Officer, Inche Othman and the loyal and enthusiastic co-operation of all the inhabitants of the sub-district irrespective of their race.

The opening ceremony was performed by the District Officer, the Hon'ble Raja Uda in the presence of a very large audience, which included the Assistant District Officer, Tengku Laximana, Tengku Badariah, Wan Halimah, Dr. and Mrs. Williams, Health Officer, Perak South, The Agricultural Field Officers, Perak South and Selangor, the Malay Agricultural Assistant, Telok Anson and practically all the European Planters and their wives from estates along the Bernam river.

The District Officer was welcomed by Inche Jamil, the Malay Officer, who spoke on behalf of the Assistant District Officer who was unwell. Inche Jamil is to be congratulated on the able way he undertook the difficult final preparations, when Inche Othman fell ill a few days before the Show.

A very full programme was arranged for the day, which included boat races in the morning, a sports meeting in the afternoon, a lantern lecture on copra manufacture by the Agricultural Department and a concert given by the local English and Chinese Schools in the evening. The latter deserves every praise, for such an effort requires courage and a vast amount of organisation, in order to bring it up to a sufficiently high standard to present to Europeans and educated Malays.

There were seventeen competitive sections covering agricultural exhibits, cakes and preserves, oils and fats, rubber, poultry, needlecraft, home industries, flowers, estate products, and including a baby show.

Special exhibits were put up by the Department of Agriculture and by the Health Department.

Kuang Mukim.

A successful exhibition of Agricultural and other produce from the Kuang Malay Reservation was held at the Kuang Malay School, Kuang on Sunday November 19th. 1933.

This exhibition was organised by the Penghulu with the aid of the Malay Agricultural Assistant, Ulu Selangor, Inche Abu Hassan.

It was well organised and a great credit to those responsible. Moreover it was entirely a local effort and received no direct financial support from Government.

The opening ceremony was performed by the District Officer, Mr. A. M. Dryburgh in the presence of a large number of local inhabitants. Among those present during the day were the Hon'ble the British Resident, the Director of Agriculture, Dr. and Mrs. H. A. Tempany, Chief Field Officer, Mr. F. W. South, Director and Assistant Director of Co-operation, Mr. R. Boyd and Mr. and Mrs. Gammons, the State Medical and Health Officer, Dr. and Mrs. Smart, the Health Officer and Medical Officer, Dr. Were and Dr. and Mrs. Grey, the Secretary to the Resident, Mr. Gordon-Hall and other European Government Officers.

In the afternoon following the exhibition the Malay School held its annual sports meeting while in the evening cinema films prepared by the Agricultural and Co-operative Departments were exhibited.

There were competitive sections for agricultural produce, fruits and vegetables, livestock, home industries for men, home industries for women. There was also a Baby Show which was enthusiastically received by the women folk present.

A display of Sakai exhibits roused considerable interest as also did the Sakais themselves who were present.

The livestock section included classes for goats and cattle, and though there were few entries, they were an innovation to agricultural shows in Malaya and are well worth encouraging.

The Department of Agriculture put up a special exhibit of considerable interest.

H. J. S.

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EDITORIAL.

The most important business, in our opinion, transacted at the Annual General Meeting of the Malayan Agri-Horticultural Association, of which a report appears in this issue was the revision of the Rules, providing for the deletion of the Associate Membership in favour of Ordinary membership at a reduced annual subscription of $2/-.

Ordinary Membership carries with it the right to receive free this publication, free admission to the annual Malayan Exhibition and any other Shows organised by the Association, the usual right to exercise a vote at General Meetings, and advice and assistance as far as may be possible in matters coming within the Association's scope.

We have long felt that the previous subscription was too high, particularly during those years when this journal was discontinued, and the Association was therefore dependent for its Ordinary Members upon people public-spirited enough to support an important and valuable body for the sake of the work done by that body. The Association still lays claim to support as a public body but it can now point to full value for the very modest subscription entailed, and it looks forward to a considerably increased membership roll in the immediate future.

The Association's activities in the past have been principally restricted to the organising of the annual Malayan Exhibition at Kuala Lumpur and to assistance in connection with smaller Shows.

These latter district shows are becoming increasingly popular, at least nine being held in 1933 throughout the Peninsula, to all of which the Malayan Agri-Horticultural Association contributed medals and diplomas.

This year the All Malayan Padi Competition is being organised, to which we refer editorially below.

The Balik Pulau three days' Show was held last month and we learn that it is proposed to re-form a branch of the Association in Lower Perak and hold a Show probably this month. In both these cases, the Association has been asked for advice and assistance.

We have previously described the Malayan Christmas Hamper Scheme which was developed last year by the Association and which proved extra-

ordinarily successful. Numerous letters received by the organisers since the publication of our last issue prove how welcome such hampers were and incidentally, that people at home still have much to learn regarding Malaya's resources.

All of which goes to show in our opinion that the Association is playing a very valuable part in the agricultural life of Malaya and as such is a public body well worth supporting.

An appeal is being made throughout Malaya for more members and we are glad of this opportunity of supporting this appeal. Application forms for membership are enclosed with this issue FOR USE. If you are a subscriber to the *M.A.H.A. Magazine*, use one form yourself and become a member also and pass the remainder to your friends.

The All-Malayan Padi Competition. Reports regarding the All-Malayan Padi Competition, particulars of which were published in our last issue, are distinctly encouraging, and clearly show how great was the need for such a competition. In one State alone, no less than forty five Mukim Shows are being held which, we think, sufficiently demonstrates the interest the competition is arousing.

We learn also that another State which has been unable to compete this year has made arrangements for a substantial vote for the development of padi planting with a view to taking a large part in next Season's competition.

The Eleventh Malayan Exhibition Reference is made in the Malayan Agri-Horticultural Association's notes this quarter to the progress made with the organisation of this year's Malayan Exhibition and we note with considerable interest that the Trade Section has already given such definite signs of enlargement. It is the experience of the organisers that there is always an inevitable last minute rush for stall sites making the adequate allocation of space for other purposes particularly difficult and this suggests that the already increased Trade Section will be even larger in its final form.

Poultry. We fear that in past issues Poultry matters have been somewhat crowded out by other subjects, but we are arranging to publish in our next issue, with the kind permission of the Director of Agriculture, S.S. and F.M.S., an article entitled " Feeding and Sanitation of Poultry," being extracts from a series of lectures on poultry breeding given in the Rural Lecture Caravan.

We feel sure that this article will prove of considerable use to all poultry breeders.

We take this opportunity of asking readers who are interested in this subject to write to us regarding their own experiences which may be of use to other readers and we welcome informative articles on poultry breeding in general.

Agriculture.

THE CULTIVATION OF VEGETABLES AT HILL STATIONS.

BY

F. S. BANFIELD, F.L.S.

In these notes I will give the result of my own experience of vegetable growing in the hill country of Malaya. Most of this experience was gained at Maxwell's Hill, Taiping and Kledang Hill, Ipoh at elevations of from 1,500 to 4,000 feet. To this I can add the knowledge obtained at Fraser's Hill during the past two years.

Until recently the only hill stations of any size were those already mentioned but with the opening of large areas of jungle at Cameron Highlands, no doubt much useful knowledge is being gained.

Climate.

The absence of definite seasons renders gardening difficult while in the hill country the higher rainfall and thick mists are other problems with which one has to contend. However, after at time, by studying the climate, it is possible to choose the best time for our garden operations. It is, I think, fairly well known that altitude and latitude exercise a great influence on the climate. It is usually hottest at sea-level and coldest at the point farthest away from the sea. The influence of altitude on plant-life is one of the first factors to be considered by potential settlers. The climate is materially affected by the form and slope of the land while the temperature and humidity of the atmosphere must be considered. The clearing of all jungle in the vicinity of a garden has a marked effect on the climate; the soil is less retentive of moisture and becomes drier and warmer.

Preparing the Plots.

After felling and clearing the land it is usually necessary to make a series of terraces. The contour of the ground should be followed and the edges of each contoured plot firmly banked with turves to prevent washing; there should be a general slope running from the edge to the hill-face and a shallow trench to carry off the water. Grass should be grown on the slopes between each plot thereby reducing the risk of landslides during heavy rains.

The next operation is to dig the ground; digging assists the free circulation of air and water in the soil and influences the bacteria in the soil.

For general purposes it is considered that the portion of soil which contains the material for plant nutrition in an available form is seldom more than nine inches in depth. Beneath this layer is the sub-soil which is, as a rule, very poor in the hill country. Most of us have read that deep digging, trenching and similar operations are the secrets of success in gardening. This is very good advice where rich sub-soils are to be found but they are very rare in this country.

The top soil—i.e. top 6 to 8 inches—should be changkolled according to the depth of the good soil and the crop it is proposed to plant. Shallow soils being the rule in Malaya, it is necessary to make up raised beds for certain crops. Parsnips, Turnip-rooted Beetroot and long Carrots will not succeed unless there is sufficient depth of good soil for their roots. Before adding soil to the beds the surface should be changkolled lightly; this will assist cohesion.

The soil should be kept open by frequent use of the chankol or preferably a Dutch hoe, so that when the seeds commence to germinate they can do so without injury to their cotyledons or seed-leaves. So soon as they appear above the ground the more tender seedlings such as lettuce, carrots and others need protection from the sun and rain. An excellent light shade can be made from plaited palm leaves; this should be placed over the seedlings for a few days, especially during heavy rains, and removed immediately they are able to withstand the sun and rain.

Seeds and Seedlings.

Good seed is the most essential condition of success in growing vegetables. Therefore in selecting the source of supply great care should be given and a firm with a good reputation chosen.

Seeds may be saved from the previous seasons crops but care must be taken to see that they are properly dried and stored. In this country the vitality of seeds is very soon impaired and it is advisable to have seed sent out from England or Australia at intervals of about three months. On arrival they should be stored in air-tight bottle or tins and kept in a cool, dry place until required. By this means certain seed such as leek, cucumber and cabbage have been known to retain their vitality at Taiping for more than three years. On the other hand, Parsnip seed cannot be kept more than a few months.

The choice of varieties will depend largely on local conditions and is a question of practical experience by growing several kinds and selecting those which are most successful.

The site for the seed-bed should be carefully selected, and a position facing south and near the water supply is desirable. A sufficient amount of warmth, moisture and air are the requisites of germination, and these conditions can be provided only when the surface soil is fine and powdery and free from large lumps. Before sowing, the surface of the bed should be moved about and broken up and the seed sown either broadcast or in drills. Many seeds fail to germinate through being sown too deeply; a very good rule is to cover with a thickness of soil equal to the diameter of seeds in question. In the case of some varieties it is advisable to sow in boxes, transplanting to the garden when about two inches tall. Seeds should always be sown thinly—if too thick many of the seedlings will damp off. After sowing a thorough watering with a rose can be given and a light shading of attaps or palm leaves placed over the beds until the seedlings appear.

Transplanting and Planting.

The practice of sowing liberal quantities of seed either in beds or boxes is a good one, besides ensuring a sufficient number of plants for the garden; the surplus may be grown on for the purpose of replacing dead plants. The seedlings must be thinned out and the surplus transplanted to other beds before they become crowded, or weak plants will result. The best time for transplanting is in dull, cloudy or showery weather, but if it must be done during the heat of the day, the plants should be thoroughly watered and the loose soil on each side of the rows drawn to the stems of the plants. Before lifting plants, the bed in which they stand should be soaked with water; this operation is best carried out the day before removing the plants. When transplanting large plants it is a good plan to shorten some of the leaves and cut off the end of the tap-root. In transplanting onions and similar subjects which have a mass of roots, cut off the roots to within an inch of the base and shorten the tops by one third their length. The advantage of this treatment is that the roots are not so liable to be set upwards, the leaves less likely to wilt, or the plant fall over, while the work can be done more expeditiously. Apart from convenience the plants benefit by this treatment. When removing seedlings from the beds for transplanting they should be covered with a wet sack or damp sphagnum moss to keep them moist.

Watering.

This is one of the most important operations and is largely responsible for the success or failure of a crop; more plants are killed by injudicious watering than by any other cause. When selecting a site for a vegetable garden careful consideration must be given to the question of an adequate supply of water.

The operation of watering is carried out at all seasons of the year, especially in the case of plants under shelter, and is one that requires the exercise of intelligent judgment on the part of the cultivator. Proficiency in the art of watering can only be obtained by practical experience. A very common fault with many gardeners is to water plants indiscriminately at fixed periods. The condition of plants varies according to the amount of evaporation which is taking place, and the quantity of roots that are absorbing the moisture supplied to them, therefore seedlings of hard wooded plants which, in most cases, are sparsely rooted require less water than soft-wooded plants.

As a guide to the amount of water that may be safely given to a plant observe the nature of the leaves; if fleshy and large e.g. cabbage, plenty of water must be given, but plants with small leaves such as asparagus require little water and seldom need artificial watering.

Watering should be done in the early morning or late afternoon. If plants are watered in the heat of the day they are apt to be scorched by the sun. For seed-boxes, seedling beds and recently planted seedlings a watering can with a fine rose should be employed.

The temperature of the water applied to young plants must be considered: it should not be lower than that of the atmosphere. Water from springs has an injurious effect on the plants but if kept in large, open tanks it will become sufficiently warm. A very necessary appliance for all gardens is a length of hose pipe which may be attached to a tap in several parts of the garden.

Rotations of Cultivation and Cropping.

One of the first principles of horticulture is that one crop should not follow another of the same kind on the same soil. The basis of this principle is that although all cultivated plants extract the same foods from the soil there is a considerable variation in the quantities they use of any given kind-one variety using nitrogen in abundance, another phosphates, and a third potash, so that to avoid an undue depletion of any one food element, and to maintain a fairly correct balance, it is necessary to change the crops about or in other words, to have a rotation.

Other important reasons for a rotation is that it assists to preserve a proper balance between the plant-foods in the soil, and to keep in check the numerous pests. Plants with deep rooting systems draw their food from the lower layers of soil while others are entirely surface feeders. Therefore by growing successively on the same soil plants of the latter type the surface soil would in time become exhausted. A deeply worked soil will often yield good crops even if a strict rotation is not followed but a shallow soil may be a failure in spite of rotation. The fact remains that the productiveness of the soil and the health and vigour of the crops are better maintained when a rotation of cultivating and cropping is properly carried out.

In order to make the object of rotation more clearly understood the following hints may be useful. Cabbages and lettuces which are exhausting crops, should not be planted in soil which has immediately before produced a similar crop. Carrots, parsnips, beetroot and turnip will thrive in soil which has borne greens. Peas and beans may follow rootcrops such as carrots and turnips. Onions will succeed if planted in ground which has previously produced celery. Brinjals should not be grown in soil which has just borne a crop of tomatoes or chillies and never plant either of these crops successively. Sweet potatoes and yams may succeed almost any crop.

System of Cultivation.

The system of cultivation adopted in these hill gardens is on similar lines to those followed in Paris gardens. It is an almost invariable rule to grow together on the same bed two or more crops, one of which is quickly ready whilst the other matures more slowly. By careful management this intercropping is accomplished without overcrowding and with very little inconvenience. The Paris gardeners find that a limited number of crops only should be grown if a maximum profit is to be obtained but at Fraser's Hill where the garden is both a scientific experiment and a commercial undertaking trials are being made with all European vegetables.

Intercropping is an essential feature of market gardening and it is by this means that the numerous crops produced at minimum costs by gardeners are obtained. But intercropping may be easily overdone. When too many plants are contending for light, air, food and moisture it may happen that despite care and attention the produce may not develop into choice specimens. Therefore, the times for sowing and planting, distances between plants, nature of plants, period of growth and other similar details must be carefully studied.

One of the most important factors of success in securing abundant crops consists in supplying the plants with plenty of water during the growing season. This may be accomplished by laying pipes to numerous convenient points in the garden so that every part of the garden can be watered easily by means of a hose-pipe.

In a recent edition of this magazine the question of the use of fertilisers in connection with vegetable culture was dealt with, therefore it is unnecessary to dwell at length on this subject. Full detailed instructions on the culture of each crop and the fertilisers required will be given under 'Cultivation of Vegetables' where every crop is treated separately.

Essentials of successful Gardening

Drainage. Make sure the land is well drained either naturally or by other means. Drainage removes stagnant water and induces a passage of air through the soil. Plants cannot thrive with their roots in stagnant water, and aeration of the soil is necessary for healthy growth.

Lime. Always make sure that there is sufficient lime in the soil; when deficient, regular applications should be given at least every year, because lime gradually dissolves and passes out of the soil in drainage water. Lime makes heavy soils more friable and sandy soils more compact, it sweetens sour soils and strengthens the structure of the plant.

Manure. Good farmyard manure is difficult to obtain in Malaya but a good substitute is leaf-mould. Leaves collected from the jungle should be placed in a pit and the whole turned occasionally until well-decayed, when it may be spread over the land and dug in the same way as manure. Both leaf-mould and farmyard manure increase the fertility of the soil by adding humus. Fresh manure should never be allowed to come in contact with the roots of plants. It is advisable to store the manure in pits for about six months, and turn it occasionally, when it will be well decomposed.

Garden Equipment.

During the wet seasons the losses sustained are often very great and it is imperative that every grower of vegetables should have some means of growing plants under cover. By the use of certain protective appliances it is possible to become, to a certain extent, independent of seasons and climate.

Among the numerous devices which are used for this purpose nearly all have glass interposed between the plant and the natural weather conditions. The 'frame' is one of the most serviceable appliances. By its use the raising and growing-on of young plants may be carried out at any time. Such plants will be more able to withstand the heavy rains provided they are not allowed

to become weak due to the lights being kept on during good weather or because the plants are set too far from the light.

The size of the frame is immaterial provided it is serviceable and convenient but whatever the size the lights should be interchangeable. When the lights and frames in a garden are of varying sizes the result is frequent confusion and loss of time.

The light should be made to take four rows of 21 ounce glass 10 inches wide by 12 inches deep with ½ inch overlap, this gives sixteen panes to a light and, allowing for the wood, gives a light 3 feet 11 inches wide and 4 feet 5 inches deep. The glass may be bedded in putty, tacked in or placed in slots. Before use, each light should have three coats of paint or two coats of one of the good wood preservatives. Once every year the lights should be cleaned and re-painted, and all loose panes of glass secured. Two handles are fixed on each light, one at the top and one at the bottom.

The frame is made of hard-wood, preferably chenghai. All the supports should be given two or three coats of a wood preservative and, if possible, the base of each support should be embedded in cement. No wood preservative that contains creosote should be used on the frames, or the poisonous fumes given off during hot weather are likely to cause injury to the plants.

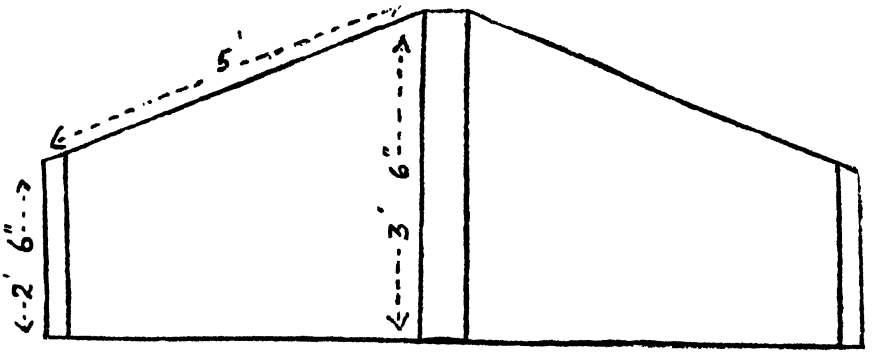

Fig. 1.
Cross section of double frame.

The illustration, fig 1 gives an idea of a double frame. A space of 5 feet should be allowed between the rows of frames in order that the lights may be opened and closed as quickly as possible. This is especially desirable during long periods of unsettled weather, as the lights need not be lifted off, but pulled down to the full extent of the frame. If the lights are lifted off two men are required but by this means one man can open and close the lights.

A single frame with open sides may also be used; such a frame is inexpensive and extensions can be made as required. The writer used several

of these frames at Maxwell's Hill and the results obtained were very satisfactory. The size is a matter of individual requirements but as the wood is heavy, and Asiatic gardeners being unaccustomed to handling lights, a smaller frame than those used in Europe is desirable.

During long dry seasons the lights may be removed and placed one upon the other to prevent them being warped.

The cost of erecting a frame 80 feet long by 5 feet wide is approximately $200/- including timber, glass, paint and labour.

The following is a list of tools and materials required for the complete equipment of a garden:—

Boxes—for sowing seeds
Chankols
Hand Forks
Manure Forks
Grass String
Hose pipe
Insecticides
Kerosene tins for carrying water
Watering Cans 2 & 3 galls.
Flower Pots various sizes
Parangs
Pruning Knife
Raffia
Scythes and Stones
Secateurs
Stakes
Syringe
Sieve.
One fine rose
One coarse rose

A Hint for Women Gardeners.

To prevent the nails from being damaged by the chemicals in the earth when carrying out any gardening task which necessitates the use of the bare hands, coat the finger-tips with vaseline and then with soft soap. If the nails are worn long, rub the tips into a piece of soap before using the vaseline. When the work in the garden is finished, wipe off all soil from the hands with a dry cloth before washing them in warm soapy water, to which a few drops of olive oil have been added.

Correspondence.

Letters are invited from readers on matters within the scope of this magazine. Names and addresses of correspondents should be given, though not necessarily for publication.

Horticulture.

TURF PRODUCTION AND MAINTENANCE

Notes on the Treatment of Golf Courses, Lawns, Tennis Courts and Playing Fields under Tropical Conditions.

BY

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Grass, most people seem to think, just grows of itself, as by some great dispensation of Nature, and thus differs peculiarly from other plants. It is only when unsightly bare patches begin to appear on a lawn that the fact that grass *does* require attention is brought home to the average gardener, who finds, often too late, that drastic and expensive reconstruction is the only remedial measure.

The truth is that a grass sward is a colony of different plant species and genera living in strenuous competition with each other requiring much more attention than the ordinary flowering plant. Recognition of this is the starting-off point for the production of order out of what can so easily become chaos. One must know exactly what to do at the right time, and to know this it is necessary to have some understanding of the nature of the species we have to work with.

Unfortunately, practically nothing is known of indigenous Malayan grasses, and very little of species imported for ornamental lawn and playing field formation. This part of the subject must be left to future investigators and we shall consider here only the briefest outline of the habit of growth of grasses as a necessary preliminary to a knowledge of turf management under tropical conditions.

The Habit of Growth of Grasses.

Grasses differ from most other plants in that they "tiller" or branch from their bases. If one strips off a grass blade, it will be observed that the leaf sheaths down the stem and that, at its very base, there is a tiny white bud—representing the embryo of a new shoot. Each leaf originates from a knot or "node" on the stem, and each potential bud is seated on a node in the axil of the sheathing leaf base. Before a grass has "shot" or come into ear, the nodes on the stem (each bearing one leaf and one potential bud) are all compacted together at the base of the shoot. One of the main ideas in turf formation is to keep them there. If the grass plant is allowed to develop unchecked, it will shoot into ear, whereby growth occurs between adjacent nodes to form a stem, and the nodes bearing all the leaves and all the potential buds are carried into the air. Potential buds then become functionless and wither away or, if the grass is scythed down, they are removed, so that in either case the formation of new shoots is impossible.

Now it is desirable for the formation of a dense compact turf to make two blades of grass grow where only one grew before, and that can easily be attained by cutting *before* the plant begins to shoot. A young shoot may possess only two lateral leaves, in the axil of each of which is a potential bud. If the leaves are cut back, these two buds will be stimulated to develop and each will give rise to a new shoot. If these shoots in turn are cut back before they can rush into ear, other tiller shoots will grow out, with the result that we can produce even hundreds of shoots from a single plant if we so desire, whereas if our original young plant is allowed to shoot and is then cut we may not have any at all.

It is imperative that this principle of grass growth be clearly understood before we can consider practical measures of grassland treatment intelligently.

One of Nature's main purposes is to secure continuity of species and the primary aim of every grass, as of every other live thing, is accomplishment of this end. The shooting of a grass means the attainment of maturity and seed production. From the practical standpoint of grass management it marks the end of the vegetative phase and is, therefore, to be avoided, since our special object is to maintain the grass in its green condition and, if we can, to prevent the seed production which terminates this.

With certain grasses, every shoot will produce an ear in one growth season. These are therefore annual grasses and of little or no use for turf formation. Other grasses characteristically form both vegetative and reproductive shoots; these are " perennial " grasses, that is, they may persist for several years or indefinitely according to species and growth conditions. The extent of the capacity of a grass to perenniate can be measured by the proportion of reproductive to vegetative shoots borne. The more "perennial " a grass is, so to speak, the more suitable it is as a lawn grass. Of great practical importance is the fact that we can firstly select a suitable perennial grass and then, by good management, keep it in the vegetative condition by judicious cutting and by fertiliser application—a point which we shall revert to later.

The above description gives the general habit of growth of an ordinary, erect, tuft-forming grass. In some important species of grasses, however, the shoots are prostrate in habit and where the nodes touch the ground, roots are produced, and surface runners formed. In other grass species, the buds, instead of growing up vertically, burst their way through the bases of the leaf sheaths covering them and make their way into the soil as horizontal, underground shoots or rhizomes. We may, therefore, conveniently group grasses into two main types according to habit of growth:—

(a) Erect tuft-forming grasses.

(b) Creeping grasses:

i. by runners or stolons.

ii. by underground stems or rhizomes.

Some species can creep both by runners and stolons and if consistently kept cut can also function as pure tuft formers.

Selection of Suitable Grass Types.

It is clearly desirable to include in a turf grass types which can creep and cover every spare corner of soil if a really satisfactory sward is to be produced, or alternatively to have grasses which can alter their growth habit to meet all conditions. This must be borne in mind when deciding the kind of turf we specially want, and how we propose to produce it.

If our aim is to produce a good playing field or golf course fairway subject to much wear and tear, comparatively coarse-growing grasses with quick recuperative powers are desirable. We would want in our turf, under Malayan conditions, a predominance of creeping grasses which can rapidly extend to cover bare areas and which, if kept cut, would form a compact if somewhat coarse turf. The ordinary Malayan " kachang " grass, is a vigorous grass very suitable for the purpose.

For tennis courts, golf and bowling greens, fine-leaved, tuft-forming grasses with hard foliage, resistant to wear, and a not too pronounced ability to creep should be selected. Only one grass species should be used, since an essential in these cases is to get a surface over which the balls will run smoothly.

For tennis courts, it is important that the grass should not be of a type which will form a mat of underlying fibre, otherwise a cushion effect will be produced and the balls will not bounce well. A more springy turf however, if the grass is otherwise suitable, is not so undesirable on golf-greens, where the prime condition is that the balls should run true. Good strains of Serangoon and Bermuda grasses possess the necessary qualities and grow well under Malayan conditions.

The first common fault in green-keeping is to commence with a grass of unsuitable type, when the only remedial measure often is the drastic one of replanting, alternatively one must be prepared to put up with a perpetually unsatisfactory green. It is not enough, even, to be content with planting up " Bermuda " grass. There are innumerable " strains " of Bermuda grass, which differ so markedly in habit that few people would realise that these are all variations of the same species. Some strains, for example, have a pronounced creeping habit and persistently form long straggly, surface runners. If these are raked up and cut off, the green is left bare. *It is, therefore, necessary to select a desirable strain of the grass which it is proposed to use, and no Green Committee should purchase shoots for planting until they have seen a specimen of the actual turf which the strain is capable of forming.*

Few people realise that a fine indigenous or native grass may be better than any imported species, grown under different soil and climatic conditions. Neither is it realised that valuable strains may be picked up locally even on poor waste land. The greens of a well-known Selangor Golf Course, the

Bermuda grass strains of which, selected locally, give surface perfection, form an outstanding example of what can be done in this way.

Soil.

Grass grows best on a medium loam which will absorb and retain water readily and not set hard when dry, and it is of great importance that the physical condition of the surface soil exploited by grass roots should be neither too heavy nor too light. Most Malayan soils are heavy clays and bake hard in dry weather and become " sticky " in wet. Sandy soils do not provide a satisfactory anchorage for grass roots and plant nutrients are easily washed out of reach. In the preparation of fine lawns and greens, it is imperative that the surface 4 inches of soil be of a satisfactory consistency. More Malayan lawns carry poor turf due to failure to provide a suitable sub-stratum at the time of their construction than perhaps to any other factor.

If no good loam is available for the purpose, it is necessary to make up a surface soil of the desired physical nature. This can be done by incorporating sand, ashes and organic matter into the top 4 inches. The sand, as mentioned elsewhere, should be of a coarse-grained type. Organic matter is best supplied by well-rotted farmyard manure or dried cattle dung, or by sewage sludge or leaf mould. (If the farmyard manure is not well rotted, there is danger of introducing weed seeds). On light sandy soils, it is necessary to add liberal quantities of farmyard manure to make a surface layer of the desired nature.

When levelling for a green site, the surface soil should first be removed, set aside, and replaced after the operation. Grass must not be planted out on subsoil.

Soils for bunkers and ridges should contain much organic matter to ensure maximum water-holding capacity and prevent them from drying out when drought ensues.

Following constructional processes, the land should be allowed to lie fallow for several months until it sinks to its permanent level during which period it should be cultivated and kept free from weeds.

Planting.

Seeding. Whereas under temperate conditions the best and most economic method of commencing a green is to grow from seed, this is not the case in the tropics. In the first place, it is difficult and sometimes impossible to obtain seeds of tuft-forming grasses suitable for the tropics, since the seed industry has not yet been developed locally. Even should seed be obtainable and sown, loss due to the depredations of ants and other subterranean insects is often so great that no turf can form within a reasonable time. It is a general rule in agriculture that seeds should not be sown deeper than their own dimensions, which means that grass seed must lie practically on the surface. When the seed has germinated, it is very liable to be dried up by the hot sun and so destroyed. Should the attempt be made to commence from seed, it is imperative to take precautions against

attack by subterranean insects, as recommended elsewhere, and to shade the surface with coconut leaves or other suitable material.

Turfing. To lay down a green from turf is almost invariably out of the question in Malaya since material is so seldom available. The method, however, is quickest and most fool-proof of all, though expensive, and may often prove best where a field has a good turf nursery. If turf is transported, it should be from the same soil type as that of the site upon which it is to be laid.

The bed should be prepared as directed for " Seeding " and the turf laid as described in the section on " Returfing."

Dibbling-in. Shoots of a desirable grass are taken and planted in the soil at intervals of about 2 inches apart. It is best to plant these shoots in diamond rather than rectangular formation and to set them lying back at an angle instead of erect. When the shoots " take " they will rapidly cover the intervening soil spaces and produce a compact turf within a few months, should all go well. It is most desirable to treat the soil with fertilisers preparatory to dibbling in, in order to give the young plants a good start in life and ensure vigorous growth. The method usually adopted in Siam of scattering shoots over the surface of a 2 inch layer of mud may give a good initial start to growth, but it is whole-heartedly to be condemned, since the ultimate effect of the mud layer is to provide a sub-stratum which cannot sustain good grass growth.

Spot-turfing. In " spot-turfing " small sections of turf, about 3" or 4" square, are taken and pressed into the prepared soil by the foot at intervals of one to two feet. This is a particularly inexpensive and rapid method of green construction, but it is imperative that a suitable type of grass be chosen. Obviously if these small turves are placed at intervals of one foot apart, the intervening spaces must be covered within a reasonable time or weeds will get a hold. The grass must, therefore, be of a creeping habit of growth in order that it may be able to produce runners or underground stems and cover the surface rapidly and effectively. The writer has seen several cases in which areas have been spot turfed with grass of a non-creeping habit, with the result that, after several years, the original turves can be clearly picked out, having made no extension of growth at all, while the bulk of the field is a mixed growth of annual weeds and weed grasses.

A fertiliser dressing should be well worked into the soil before spot-turfing and thereafter stimulative top-dressings should be given in order to keep the grasses in maximum vigour and secure rapid cover.

Returfing.

Assuming that a satisfactory turf has been obtained, it is only too easy to ruin it at the outset by bad laying.

First the turves must be cut to even size and thickness taking care that the cut edges are vertical. 12" x 3' is suitable, with a turf thickness of

1" to 1½"—the thinner the better, provided the roots are left. Roll up for transport.

Never lay turf on pure sand, and never lay soil on top of sand or caking will result: use a substratum of loam or of soil and sand mixture. Before laying, firm the ground by rolling.

Turf for setting should never be allowed to lie about in heaps but should, if possible, be cut and laid on the same day.

Leave spaces of not less than ½" to not more than 1" between turves to allow for expansion in the subsequent beating down. In estimating the amount of turf required, allow 5% of the area for these cracks. Set 3 - 4 rows only at a time, then beat and level. Remedy the slightest defect at once by packing in or renewing soil. Beating must be done carefully and on no account must turves be beaten too flat. During laying, no water must be given and work must cease should heavy rain come on.

Where turf has to be laid on a slope, the soil must be well-trodden into the bank and the turves, if necessary, pegged into position. The bottom and top rows should be laid horizontally and the others vertically.

When laid, top dress evenly with a mixture of good loamy soil and sand, brush this into the interspaces, and water until saturated. Roll next day. It is, of course, imperative that all play should cease over the area until the grass has taken root.

Turf Nursery.

Every grassland area of any size should have a nursery from which turf can be drawn for repair work. One of the main defects of most Malayan playing fields and golf courses is that they are without turf nurseries.

In preparing land for a turf nursery, the existing turf should be changkolled over and deeply buried. Well-rooted farmyard manure should be worked in to a depth of 3" to 6" and the ground then levelled, raked and allowed to lie fallow for several months until it sinks to its permanent level. During this period weeds should be destroyed. The ground should then be levelled and raked preparatory to receiving the seed, shoots, or turves, whichever method of planting up may be decided upon.

When cutting turf for repair work, leave a small edge of grass still growing in the nursery in order that the turf may re-establish itself. If this correctly done, a comparatively small nursery will be sufficient to supply a large area of field.

Drainage.

Defective drainage is one of the most common and most serious causes of poor grass growth. Greens and playing fields which might otherwise be in perfect condition often remain permanently third-rate due to constructional defects in this respect. The importance of ensuring that an adequate system of tile drainage is laid down when greens are under construction cannot well be over-emphasised.

Plants cannot use gravity water and will quickly die out in waterlogged soil. They use only capillary water in aerated soils, the presence

of oxygen being necessary for root growth. The peculiar idea of draining is to remove water in order to make more available to plant roots and at the same time to improve soil aeration.

Constructional Drainage. Briefly, a drain will remove gravity water from a wedge-shaped area of the soil immediately above it, known as the "cone of exhaustion." For complete surface drainage, drains must be so spaced that the cones of exhaustion overlap. This means that on sandy and loamy soils 2½" tile drains should be laid about 2 feet deep and 15 feet apart, and on heavy clay soils about 1½ feet deep and not more than 9 feet apart. If there is danger of drought, these spacings could be doubled provided the system is sufficient to prevent heavy rainfall from lying too long. As a general rule, nothing approaching these measurements is kept, with the result that greens and playing fields are usually badly drained. The beneficial effects of adequate drainage are clearly marked by the better growth and darker green colour of the grass immediately over the drains, by which one can tell their position.

Drains should be laid in herring-bone fashion with 2½" laterals running into a 4" main.

Prevention of Seepage. Before constructing a green it is necessary to consider the general lie of the land. Should a green be situated at the foot of a steep bank, then a catchment drain should be placed on that side. To do this, dig a trench to a depth of about 3 feet and plaster the side next the green with puddled clay. Place a tile drain on the bottom and cover with stones and rubble, then to the top with soil.

Surface Aeration, Piercing. It often happens that although the drainage system is efficient, the superficial ¼ inch or so of soil becomes hard and badly drained, due perhaps to severe play, over-rolling, or to compacting by heavy rain. This is often only noticed first by the appearance of bare patches and by the occurrence of a blackish skin-like growth over the area. The remedy consists in piercing to aerate the soil.

Piercing is done by means of a straight-pronged fork, having prongs about 4" long, 2" apart, and ½" thick in cross section. The fork is pressed into the ground with the foot to its full depth and then removed, leaving distinct perforations. The spiked rollers on the market are not usually very effective for the purpose. A fork-changkoll can also be used.

By piercing, air is introduced into the soil and superficial drainage so obtained. Following piercing, the green should be top-dressed with a mixture of good, dark soil and sand and this then rubbed into the perforations by means of a wooden, squeegee-shaped board. It is desirable to mix a little artificial fertilizer with the soil in order to accelerate growth.

Watering.

Efficient watering is one of the main features in keeping greens up to standard, particularly in districts liable to suffer from drought. But

there is a right and wrong way to water grass, and more harm than good can be done by bad methods.

The essentials of good watering are that it must be carried out in the evening—never when the sun is shining, while greens should receive a thorough drenching, and not a light sprinkling each time.

The surface should never be allowed to dry out. If this happens, for any reason, it may be difficult or impossible to saturate the turf, in which case the surface should be broken with a spiked roller before watering. Particular attention should be paid to mounds, banks and elevated portions in time of drought, since these are liable to dry out quickly.

To water sparingly can be worse than not to water at all, and mere sprinkling of the surface when watering is one of the common causes of turf deterioration. Sprinkling encourages the formation of surface roots with the double evil of causing sun scorch and of limiting the zone which the plants are able to exploit for food supply. The only time light sprinkling should be given is a preliminary to drenching, in order to prepare the soil for the water to soak in.

When food supply is good, drought need not be feared, since well-nourished, sturdy plants have deep root systems.

Cutting.

Reference has been made to the effect of cutting in making two shoots grow where only one grew before, and mowing should always be done with this principle in mind. *On no account should fine turf grasses be allowed to shoot.* If a turf is being formed either from shoots or seeds, or if an established turf is under repair and is resting, the grass may be permitted to grow to a height of about 3 inches before cutting back, but great care must be taken not to allow it to pass into the shooting stage. Good greens are often ruined by allowing resting turf to grow too long, with the result that, as already explained, the potential buds are lifted above the surface and removed at the first cutting, leaving the greens bare.

If the idea of resting a particular green is to give time for bare patches to be covered, the grasses should nevertheless be cut back before shooting and again allowed to attain a reasonable height before cutting again, but they must not be left to grow indefinitely merely because the bare patches have not been covered over before the grass shoots.

Where grass has been rested and is rather long, and particularly in the case of a newly established turf, the first cutting should always be done with a scythe in order to make the initial cut as clean as possible and to prevent shoots from being torn out of the soil. If no coolie is good with the scythe, the initial cut should be made with a mower riding high.

An important effect of cutting is that it causes the grasses to assume an erect, tuft-forming habit and to produce fewer runners. The reason for this is that long runners are never allowed to form. If cutting of a green has been so neglected that there is a predominence of long straggling runners,

it is best to rake the surface lightly to loosen these and scythe them off preparatory to closer cutting. Following this treatment, it is imperative to give a top dressing of fertilizer in order to encourage vigorous, recuperative growth. If a green mainly consists of runners, raking might prove too drastic. The best treatment would then be to replant with a more desirable grass type.

When grasses are consistently kept short, as they are in fine greens, it is difficult for them to obtain the necessary nutrients owing to paucity of foliage and shoot roots. Close cutting should never be undertaken unless an adequate supply of plant nutrients is available. The application of fertilizers in constant small doses and close cutting go hand-in-hand.

Once a compact even turf has been established, it is not difficult to maintain. The essential thing is to understand the habit of growth of grasses, to be watchful of the slightest signs of deterioration and to adopt appropriate remedial measures without delay.

Rolling.

Injudicious rolling is one of the main causes of poor lawns and putting greens. The great rules are: never use a heavy roller and never roll when the ground is either soft and wet or hard and dry.

The object of rolling is to reduce minor irregularities and to produce a uniformly firm surface. It is futile to attempt to roll untrue surfaces even. Heavy rolling of elevated portions in the endeavour to level them merely results in compacting the surface, with the result that the soil bakes hard, grass cannot grow, and bare or weedy patches are formed. The same result obtains if rolling is done during rain or when the soil is wet; the softer the surface when rolled, the harder it will be when dry and the greater will be the number of bare patches. If the surface is elevated, cut the turf and roll back, take away some soil and replace the turf again. If the soil is constantly too soft, drain—but do not roll until the defect has been corrected.

The more frequent the rolling, the lighter should be the roller. In such cases, use a wooden roller. The best metal rollers have two cylinders and rounded edges, so that the turf is neither scraped nor cut. On each successive rolling occasion, roll at right angles to the previous one, and be sure to brush the greens first.

Sanding.

The practice of top-dressing greens with pure sand is not advisable under Malayan conditions, since it tends to produce scorching and, in any case, the sand is rapidly washed off by heavy rain.

Sand is of use, however, for mixing with clay soils at the time of green construction in order to improve the texture, or for mixing with heavy soils for top dressing if no loams are available. The sand used should be a coarse-grained sea sand having angular particles and not a " dune " or wind-blown sand.

Fertilizer Treatment.

Apart from faulty green construction—principally ineffective drainage systems—the most serious fault of Malayan green keeping is failure to use fertilizers. Since ornamental and playing field grasses are kept constantly cut down, they have difficulty in obtaining an adequate food supply and, if shortage occurs, bare patches rapidly form. Moreover, the constant removal of the cut grass soon depletes the soil of its food resources, particularly since the roots only exploit the top 2 to 3 inches.

Under tropical conditions, the nutritional needs of grasses are best and most economically met by the use of artificial fertilizers.

On many Malayan soils, the best results are usually obtained by use of a complete fertilizer, and Enpekay No. 5 is to be generally recommended. For fine greens a complete fertilizer is essential; but the coarser grasses of fairways, playing fields, racecourses and aerodromes respond well to Sulphate of Ammonia, though satisfactory growth cannot be maintained indefinitely by its use alone. In the latter case, it is best to dress once each year, or once every second year with Enpekay No. 5 and to give intermediate treatments with Sulphate of Ammonia.

In fertilizer treatment, the ideal is "little and often." It is much better to apply small doses at monthly intervals than to give heavy, single, annual or semi-annual treatments. *The application of artificial fertilizers in small doses at frequent intervals is the key to the production of satisfactory turf.*

Treatment should be varied according to growth made and not worked out to any automatic scale, that is, manuring should be done immediately greens show the slightest signs of wear and should continue with small monthly or even fortnightly dressings until growth becomes vigorous, when treatment can be restricted. No mistake could be greater than to allow bare patches to form, since it is difficult to get these covered again within a reasonable time without returfing or dibbling-in, and during this period play must cease. It is important to commence treatment early.

For the coarse grasses of playing fields, 2—3 cwts. per acre of Sulphate of Ammonia should be applied semi-annually. If in poor condition, applications of 2 cwts. per acre can be given at quarterly intervals until growth is good. Treatment with Enpekay No. 5 should be at the rate of 4—5 cwts. per acre once every eighteen months or two years, when the Sulphate of Ammonia dressing can be with-held.

On fine lawns, cricket pitches, bowling and putting greens, use of Sulphate of Ammonia should be made with care in case growth becomes too rank. Dressings should be at monthly or two-monthly intervals, according as growth is backward or good. It is best to use Enpekay No. 5 at the rate of 2 lbs. per 100 sq. yards per month, or per two months. If a more restrained growth is desired, use can be made of a mixture of half parts by weight of Bone Meal and Enpekay No. 4, in which case about half of the nitrogen and phosphoric acid is in slow-acting and half in quick-acting forms.

Instead of Sulphate of Ammonia, effective use can be made of I.C.I. Lawn Fertilizer at the rate of 1—2 lbs. per 100 sq. yards at one or two-month intervals, where it is desired to control weeds as well as to fertilize greens.

There are two main ways of applying fertilizers to grassland; by broadcasting the solid material mixed with soil, and by application in water solution. The former method is best suited for playing field treatment and for repair work on greens in poor order. The fertilizer must be mixed with about 5 to 10 times its bulk of good, dry loam, otherwise the grass might be scorched. By mixing with earth, scorching is obviated and distribution is more even. Dressing is done by throwing the material vigorously into the air with an upward sweeping motion of the arm, so that the material falls as a light, even spray. It is best to divide the area under treatment into sections with string and to apply the fertilizer soil mixture in so many even doses. Apply in the early evening after a dry day when there is no rain or dew on the leaf. If practicable, it is best to water after treatment, or to dress when light rain is expected. Applications should be with-held during dry weather.

Owing to the amount of water-carrying required, application in solution is more usual on fine greens. The method reduces the risk of loss by rain wash and ensures that the food supplied is immediately available to plants. To apply in solution, disolve one cigarette tin of fertilizer (about 8 ounces) in 4 gallons of water and apply this by watering can to 18 sq. yards. If the greens are backward, water monthly with this solution until they are restored to vigour, when treat at 2 monthly intervals.

It is not good practice to apply lime to grassland, but if the soil is a very heavy clay it is a good plan to mix ½ to 1 cwt. of freshly slaked lime with the sub soil at the time of green construction.

Weeds.

The presence of weeds is usually direct evidence that factors are at work inhibiting grass growth and so permitting weeds to establish themselves. Weeds seldom occur on well-nourished greens. Malnutrition is a main predisposing factor and should be corrected by the application of fertilizers. I.C.I. Lawn Fertilizer, which was evolved from a formula of the British Board of Green-keeping Research, contains chiefly Sulphate of Iron and Sulphate of Ammonia and performs the double function of weed destruction and grass nourishment at the same time, owing to the selective action of these ingredients. By repeated dressing with this fertilizer, weeds can be kept permanently controlled.

Bad drainage is also an important factor in producing weeds, since it leads to poor grass growth. If the fault is constructional, the remedy lies in correcting drainage defects. If superficial drainage is bad, due to over-rolling or surface compacting by heavy rain, the obvious remedies should be taken.

Where weeds predominate over the grasses, it is advisable to returf the whole green, or at least the worse patches.

Large scattered deep-rooted weeds are best removed by hand, but, if this is impracticable, a useful method is to pierce the centres of weeds with a sharp-pointed steel prong dipped in concentrated Sulphuric Acid. Alternatively some petrol can be injected into the crowns by means of an oil-can to which a sharp piercing point has been attached. Another convenient method is to drop a pinch of Sulphate of Ammonia on to the cut crowns. This kills the weed and at the same time fertilises the surrounding grass and enables it to cover the bare spot rapidly.

Weeds on pathways can easily be killed out by application of Sodium Arsenite at the rate of ½ lb. per 100 sq. yards, applied in water solution, but this poison must not be allowed to touch the green.

Worms.

Although it is true that worms perform a slight service by aerating the soil, they do much more harm than good and must be exterminated where plentiful. Worm casts form minature seedbeds for weeds and this is the reason why greens clear of worms are freer from weeds. Greens also run truer when worms are removed. Unless care is taken to switch aside worm casts before rolling, the earth heaps become pressed into the soil forming hard plugs or "corns" through which grass cannot grow. Each such dead spot is the nucleus of a future bare patch. (This, incidentally, is one advantage of a light wooden roller; it picks up worm casts instead of flattening them down as a heavy iron roller would).

The remedy for worms consists in watering the ground with a solution of 1 oz, Mercury perchloride in 30 gallons of water per 300 sq. yards, and then applying 50 gallons of pure water. Worms should be brushed off the surface when they come up. Treatment is best given when the soil is wet and the worms are active. It is best not to roll for a time prior to treatment to allow the worms to open up their runs.

Another cure, but not so good, consists in drenching the greens with lime water prepared by steeping 20 lbs. quick lime in 40 gallons of water and decanting and using the clear solution.

Recent trials conducted at the Experimental Station of Imperial Chemical Industries Ltd., at Jealott's Hill show that Sodium hypochlorite is an effective worm-killer when applied at the rate of 2 oz. per square yard in two gallons of water. It is more lethal than Mercury perchloride but may scorch the turf temporarily.

It is important in all worm control measures that the soil be thoroughly drenched with the solution.

Soil Fungi.

If the ground has long been allowed to remain in a compact, unaerated state, it is practically certain to have become infested with soil fungi, such as Rhizoctonia, which parasitise the grasses and cause bare patches. To

cure this, first pierce the green thoroughly, particularly round and over the bare patches and drench with a 1: 1,280 solution of Mercury perchloride in water (i.e. 1 oz. to 10 gallons) using about 1 gallon per 2 sq. yards. One week later, top-dress with a soil-sand mixture to which has been added bone charcoal at the rate of 1½ lbs. per 10 sq. yards (not 10 yards square).

Algae.

The black, skin-like growth commonly found on greens is produced by fresh-water algae which would not have been present if the soil surface had been adequately drained. As a rule, superficial aeration and drainage by piercing, followed by the usual top-dressing of soil and sand rubbed into the perforations, is sufficient to remedy the trouble. If this does not cure, the surface should be drenched with a solution of Mercury perchloride or with a very dilute solution of Copper sulphate in water.

Insect Pests.

Grubs attacking grassland can usually be controlled by preparing a suspension of Lead arsenate at the rate of 1½ lbs. per 50 gallons of water. and applying this by watering can at the rate of 1 gallon of solution per 2 sq. yards of turf. Alternatively, treatment with Mercury perchloride might be effective at the rate of three applications in one week of a 2 oz. to 30 gallons dilution using 10 gallons of solution per 100 sq. yards.

Subterranean ants can be repelled from greens by the injection 3" to 4" deep, at 1 yard intervals, of $^1/_{10}$th oz. doses of Paradichlorbenzene. Where large nests are found, the turf should be changkolled open and a teaspoonful of Cyanomag inserted, and the turf then replaced. Alternatively, an ounce or two of Carbon bisulphide can be poured in.

For fairways and playing fields attacked by " fire " ants, the best method consists in changkolling open a turf over each site and pouring in a half-cigarette tinful of Carbon bisulphide. This is then ignited from a safe distance by means of cotton wool on the end of a long stick and the whole covered over. Carbon bisulphide is highly inflammable and ignites with explosive violence, so that care must be taken in handling it. An alternative is to sprinkle in some Cyanomag powder.

To control White Ants, Carbon bisulphide can be poured into galleries which are then closed up, or alternatively the chemical can be ignited as described above. Treatment does not always meet with success and nests should be looked for and destroyed when found.

KENG HWAH.瓊花

BY

R. E. HOLTTUM, M.A., F.L.S.

Director of Gardens, S.S.

Within recent years a plant known locally as Keng Hwah (Mandarin) or Keng Fa (Cantonese) has come to be commonly grown in Malaya for its beautiful fragrant flowers, which open at night. The plant is reputed to have come from China, and many stories are current concerning it, some of them apparently the result of speculation and rumour. The facts of the case are rather less romantic than some of these stories assert; they are however of considerable interest, and are worth putting on record. As will shortly be apparent, there are gaps in our knowledge, especially as regards the local introduction of the plant, and I should be grateful to anyone who can throw further light on that question.

The botanical name of the plant is *Epiphyllum oxypetalum*. It has also been called *Phyllocactus grandis*. There are a number of species of Epiphyllum or Phyllocactus (the former is now considered the more correct name), all native in Tropical America. About half a dozen species resemble *E. oxypetalum* in flowering at night; the others flower in the day-time. The day-flowering species have been much hybridised and many varieties have been produced. Their flowers are usually red or pink and they are very beautiful, but the only varieties so far tried in Malaya refuse to flower. The night-flowering species are naturally of less general interest, and have not been so much favoured by attention from plant breeders. *Epiphyllum oxypetalum* in particular requires quite warm conditions for good growth, and is not easy to cultivate in European hothouses. It is known in England, but is not generally offered for sale in dealers' catalogues. It is said to be more frequently cultivated in America. Its native home is the region from Mexico to the northern part of South America.

Now comes the question: how did this plant, a native of Central America, reach Malaya? And the second question also arises: how did it acquire the Chinese name Keng Hwah?

I may perhaps first give my own evidence. When I came to Singapore in the middle of 1922, there was an Epiphyllum growing in the Singapore Botanic Gardens. This was not the plant now called Keng Hwah, but an allied species, and was labelled *E. Hookeri*, it had red stems and smaller flowers, which also opened at night. This species had been introduced to Singapore from England many years previously, apparently under the name *Phyllocactus latifrons*. It was not in general cultivation, and probably known to few people. There were no plants of the Keng Hwah in the Gardens at that time, nor do I remember seeing any until 1923 or 1924; I cannot be sure of the date.

Keng Hwah.

The next piece of information is that in 1923 Mr. Tan Tang Niah had a plant which he called Keng-Fa, which he showed in flower to Mr. I. H. Burkill, then Director of the Singapore Botanic Gardens. Mr. Burkill identified the plant as *E. Hookeri*, thinking it was the same as the plant in the Botanic Gardens, but it is almost certain that he was mistaken in so doing, and that Mr. Tan Tang Niah's plant was the one now generally known as Keng Hwah. Mr. Tan Tang Niah stated that he received the plant from Amoy and that it first flowered with him in May 1922.

About 1923 the Keng Hwah was being propagated by Chinese gardeners, and fine plants are said to have been sold for large prices. Mr. Burkill also states that the flowers were offered for sale as a drug of immense value. By 1926 the Keng Hwah was well known in Singapore and the other species which was earlier introduced was also fairly often seen in cultivation. Now nearly everybody has a plant, and everybody knows the beautiful fragrant flowers.

The only positive evidence is then that Mr. Tan Tang Niah received a plant from Amoy not long before 1922, that in 1922 and 1923 the species was a rarity in Singapore, and that by about 1926 it had become common. We can put the date of introduction at about 1921 without much doubt. It is of course possible that other persons also introduced plants at about the same time. As the plants were introduced from China, and as the species is little known in cultivation in Europe, the probability is that they came from America across the Pacific, very likely by way of Honolulu and Manila, whence they could easily reach Amoy; but that is only a guess. I should judge that the climate of southern China is not so favourable for the plants as that of Singapore. Mr. H. Green, of the Hong Kong Botanical and Forestry Department, kindly informs me that the plant is known in Hong Kong but little cultivated.

Now about the name Keng Hwah. This name has its origin in Chinese literature. The following extracts give the information which is available on the subject:

1. Extracts from the Chinese Encyclopedia Chi Yuen, 9th Edition. 辭源

Keng-Fa-Koon (瓊花觀) was erected in the Han Dynasty [about B.C. 12] in the suburbs of the city of ancient Yang-Chow. It got its name from the general belief that the Keng-Fa plant was once grown there. In the Sung Dynasty it was renamed Fan-Li-Koon 蕃釐觀 (Vol. II, section 1 (午集)page 42).

Keng-Fa, a rare and precious plant, of which there was only one grown in Yang-Chow in the ancient Hau-tho-chhi (后土祠), which was called Fan-Li-Koon (蕃釐觀)in the Sung Dynasty. According to a legend it was believed that this plant had been planted in the T'ang Dynasty [618 A.D.—959 A.D.]. The leaves of this plant were soft, smooth and shining. The flowers, large, with thick petals, were pale yellow and produced unusual fragrance. In the Sung Dynasty Emperor Yan-Chong (仁宗)

removed it and transplanted it to his forbidden garden, where it thrived well for a year. After a year, it gradually showed signs of declining in health. Therefore Yan-Chong removed it back to its former abode, where it then revived till the middle of the Yuen Dynasty (元朝) when it died [about 1320 A.D.]. After its death a Taoist priest, Kam-Yu-Sui by name, planted in its place the Pat-sin-fa (八仙花). So that after this, what the people of the Yuen Dynasty called the Keng-Fa, was in reality the Pat-sin-fa, which was planted by the priest. (Vol. II section 1 p. 41).

Pat-sin-fa, a deciduous shrub about four to five feet in height. The leaves are in pairs; one opposite the other on each side of the stem. They are smooth and oval in shape. The flowers are in clumps, many of which unite together in the shape of a ball; thus the flower is called Chu-pat-sin, (聚八仙) [meaning a group of eight fairies]. The flowers change colour often. It is also called Yong-sou-kow (洋繡球). (Vol. I section 1 (子集) p. 276). [Yong-sou-kow means literally Foreign Ball-flower and is the name by which the common Hydrangea is usually known in China].

2. Extract from the Story of the Chui Dynasty (隋唐演義); *Vol. IV Chapter 47.*

Emperor Yang-Ti (隋煬廣) [605—616 A.D.] of the Chui Dynasty had a Keng-Fa plant in Fan-Lei-Koon. This was the only one found in the kingdom. Upon information that the plant was in bloom, he and other courtiers hurriedly repaired to the place to see the flowers, but to his grief, he found that the beautiful flowers had been carried off by a strong gale. His anger maddened him, and to appease his wrath he had the plant uprooted and destroyed.

It was said that the Keng-Fa was planted by a genius, Fan-Lei by name. He buried in the ground a piece of jade and in a short while a plant sprang up from the place where the jade was buried. This plant bore flowers that were as pure and white as jade, and the people called it Keng-Fa [meaning Jade-flowers].

It is therefore apparent that the name Keng Hwah properly refers to a plant which died long since in China. Nobody can identify that plant botanically or say whether others like it are still living; it may indeed only have existed in the imagination or historians. If any evidence were needed that the plant now called Keng Hwah cannot be the same as the traditional one, it is supplied by the fact that *Epiphyllum oxypetalum* is a native of Central America and cannot have existed in China in ancient times.

In A Complete Dictionary of Botanical Terms (植物學大辭典) p. 1497, there is an illustration and description of a kind of Epiphyllum which is cultivated in China. This Epiphyllum is one of the red-flowered (day-flowering) kinds, and is quite different from the Keng Hwah. It has probably been introduced into China in recent times. The name given is

I have no information as to the origin of the use of the name Keng Hwah for Epiphyllum. It may have been given by someone in Amoy; but Mr. Green informs me that he has no evidence of its use in southern China. It seems more probable that the name was given by someone in Singapore; perhaps when he first saw the flowers he was so impressed that he thought of one of the most remarkable plants of Chinese history and used the name Keng Hwah, which then became current, or perhaps some grower of plants thought that the name would attract customers. The remarkable nature of the plant combined with the great beauty of its flowers were indeed enough to attract buyers, even without any historical or legendary associations, but undoubtedly a name was needed, and Keng Hwah served the purpose. It has come to stay, and we may welcome its use.

Now we may add something about the plant itself. It belongs to the Cactus family, most members of which have the peculiar character that they have no proper leaves. In most cases their stems are fleshy and their leaves are represented by slender spines. They grow in desert countries and their peculiar structure enables them to resist loss of water. The genus Epiphyllum does not grow in desert conditions, but in moister climates. It is by nature a climber or epiphyte, growing on trees somewhat the same way as orchids do. It has the fleshy stem usual in the cactus family, but the stem is flattened and rather leaf-like. The true leaves are minute organs in the notches on the edge of the flattened stem; they may usually be distinguished near the growing end of the stem but on older parts have withered and fallen. The flowers are also borne in the notches on the edges of the flattened stems. There are many petals, the outer ones serving a protective function in the young flower; there is no clear distinction between petals and sepals.

Epiphyllum Hookeri, the other species sometimes locally grown, differs from the Keng Hwah in having stiffer stems, usually more or less red in colour, the outer petals reddish on the outside, and the style also red. (The style is the slender organ in the middle of the flower, which bears at its end the star-shaped group of stigmas). The petals are narrower and fewer in number than those of the Keng Hwah, and the flowers are smaller. The plant also appears to be less free-flowering.

Strong Keng Hwah plants flower frequently and freely. There is certainly some tendency for many plants to flower together on certain nights, and this is probably due to some change in temperature or other stimulus which starts the buds all developing at the same time. There are no proper records of this simultaneous flowering; any regular records over a period of several months would be interesting and might throw some light on the stimulus which causes the flowers to develop.

The cultural treatment most suitable to Keng Hwah plants is similar to that required by some of the larger orchids. They need plently of drainage, to ensure free aeration of the roots, and when in active growth will respond to regular manuring. They need a sunny place, but something less than

full exposure to sun all day is best. Long shoots, especially in rather sheltered positions, often bear roots, and it is probable that plants could be trained to climb up tall wooden supports. A fence of Keng Hwah plants in flower would be a fine sight.

I have pleasure in acknowledging the kind assistance of Mr. Sng Choon Yee of the Chinese Protectorate and Mr. Quan Ah Gun of the Botanic Gardens Office in connection with references to the Chinese literature concerned in this article.

The photograph accompanying this article was made from a plant belonging to Miss Lane, C.E.Z.M.S. School, Singapore.

Sisal.

Sisal, the plant which makes ropes and binder twine, has assumed a place of increasing importance among Empire products during the past few years. British East Africa alone is responsible for nearly one-third of the world supply, producing and exporting over 72,000 tons in 1931, against a world total of 230,000 tons.

The growing importance of sisal to the Empire has led Dr. S. G. Barker, director of the Wool Industries Research Association, to codify the present knowledge of the character and properties of the fibre in a report issued recently by the Empire Marketing Board.

Apart from local uses for such purposes as hammocks, hats, braid, sacking, the uniformity of length, quality and appearance with which the fibre can be marketed make it eminently suitable for the production of binder twine, cords and fine yarns. But the rapid replacement of the binding machine by the combined " harvester-thresher " foreshadows a narrowing market for the twine, emphasising the necessity of extending its uses for commercial purposes.

BURNT EARTH

BY

M. R. HENDERSON.

For many purposes it is necessary or desirable to sterilise soil. The process of sterilisation frees the soil from unwanted seeds, and also from harmful fungi and animal pests. The easiest way to effect this is by applying heat, either as steam, or by baking or burning. In glass-house culture in Europe steam sterilisation is largely employed; various ovens have also been devised for baking soil to an even temperature about equal to that of steam, to sterilise the soil without heating it so much as to alter appreciably its texture or its chemical composition.

The Chinese gardener, when preparing soil for pot plants, does not merely steam or bake it sufficiently to sterilise it, but burns it almost to the consistency of a brick. His primary object is not sterilisation, but the preparation of a soil which can withstand heavy rain and copious watering without being reduced to a muddy consistency. This ensures good drainage and consequently good aeration, which is essential for healthy root growth.

By such drastic treatment, almost all organic material, including all nitrogenous plant food, is destroyed, and this must naturally be replaced. As described below, the earth when burnt is mixed with cow-dung (or some other organic material), which has not been sterilised; with this cow-dung are added large quantities of bacteria and other organisms. These organisms are however presumably of a different nature from those in the original soil, the sterilisation of which doubtless confers some benefit. The principal benefit however is clearly the improvement of the mechanical condition of the soil.

Black top soil is preferred to any other, partly because it can be changkolled in large lumps without much waste, often being bound by grass roots, and partly because it breaks up with little dust after burning. Clay can also be used, but it is said to have a tendency to crumble after burning. It is essential to have the soil in compact cubes so that it can be handled easily without breaking up. It is a waste of time to try to burn dusty or much crumbled soil.

The quantity to be burnt at any one time is dependent on how much is available, or how much is needed, but it is probably more economical in firewood to burn a fairly large quantity, say a cubic yard, and store it.

The earth is carefully stacked up in the shape of a beehive over a core of firewood, and an opening is left in one side through which the fire is lit and fanned. The opening is usually not closed until most of the moisture has been driven off the soil and until the larger pieces of firewood are seen to be well ignited. It is then closed up with more earth, and the fire left to smoulder until the outside layers of earth are well burnt. About 48 hours suffices for the whole process.

It is, of course, necessary to protect the soil from rain both during and after burning by means of a simple attap or galvanised iron roof.

The burnt clods are whitey-grey in colour, hard and dry, and should break into small pieces with the minimum of dust. They are prepared for potting by breaking them up into pieces about the size of a walnut. A certain amount of dust is unavoidable. Meanwhile a quantity of cow manure has been spread out to dry, then pounded and pulverised as finely as possible, and this is mixed with the burnt earth roughly in the proportion of one part of manure to two of earth. The pot is filled with the mixture to within an inch of the rim, the top layers being composed of the smaller pieces and dust. The pot should not be filled completely, as otherwise the soil will tend to be washed away during watering.

Further manuring is carried out during growth by the addition of an artificial fertiliser or of ground-nut cake. The method of application varies according to the weather, at least where the plants are not under cover. In dry weather the fertiliser may be watered on, but in wet weather, when watering is not necessary, small pieces of the cake are buried below the surface of the soil and left to rot, and artificials can be sprinkled sparingly on the surface.

The M.A.H.A. Magazine was revived last year in its present new form, and a limited number of back numbers are available. Application should be made to the Editor, 12, Barrack Road, Kuala Lumpur.

Bougainvillaea formosa at the Waterfall Garden, Penang

NEW OR INTERESTING ORNAMENTAL PLANTS.

Bougainvillaea formosa.

In April last the Rev. Keppel Garnier received from Peradeniya a plant of *Bougainvillaea formosa* and this he very kindly presented to The Waterfall Gardens, Penang.

It was planted out early in July and quickly produced several strong erect shoots about five feet in length. Within a month it commenced to bloom and quickly produced the compact inflorescences seen in the illustration.

The flowers are a bright mauve and very different from the varieties commonly grown in Malaya.

The leaves are dark and glossy with few hairs along the veins. They are rather large, up to five inches in length, and are narrowed to base and apex.

This promises to be a very useful addition to our collection of Bougainvillaea for it remained in bloom for about three months in spite of a good deal of heavy rain and now, a month after pruning, it is flowering again.

Macmillan in " Tropical Gardening and Planting " figures Bougainvillaea formosa and the name is also mentioned in Bailey's " Standard Cyclopedia of Horticulture " where it is referred to Bull. Presumably it was described and named in one of the catalogues of W. Bull, an importer and grower of tropical plants during the second half of the 19th century.

G. A. Best.

Fagraea Auriculata.

The flowers of this plant are among the largest of all native Malayan flowers, and though they are produced only once a year (in Singapore) they are so remarkable and handsome that the plant deserves to be better known and more frequently cultivated.

Like several allied plants, this Fagraea grows normally as an epiphyte on other trees, but it will also grow as a bush or small tree in the ground. It will attain 20 feet or more in height under favourable conditions. It is slow in growth, and seems to prefer a position half sheltered by taller trees and open to the morning sun. The twigs are thick and bear large dark green leaves, which may be a foot long and about four inches wide. In Singapore the flower buds appear about April and open about July. The flower is nearly pure white when it first opens, very thick and fleshy, and heavily scented. It opens in the evening, and during the night the stamens shed their pollen, which may come into contact with visiting insects; by morning the stamens have withered. The next day the flower remains open, and is then at its finest. During the second night the style elongates and the stigma expands into a circular plate, and can receive pollen which may

be brought by insects from other flowers. By next morning the flower has a creamy tinge, which gradually deepens while the flower lasts for still another two or three days. The flower is eight inches or more across the mouth, and the tube into which the petals are joined is about six inches long. The fruit is egg-shaped, fleshy, takes several months to ripen and contains many small seeds. Seedlings are very slow in their early stages, and propagation is more easily effected by marcots. R. E. HOLTTUM.

The Forget-me-not Anchusa.
(Anchusa Myosotidiflora).

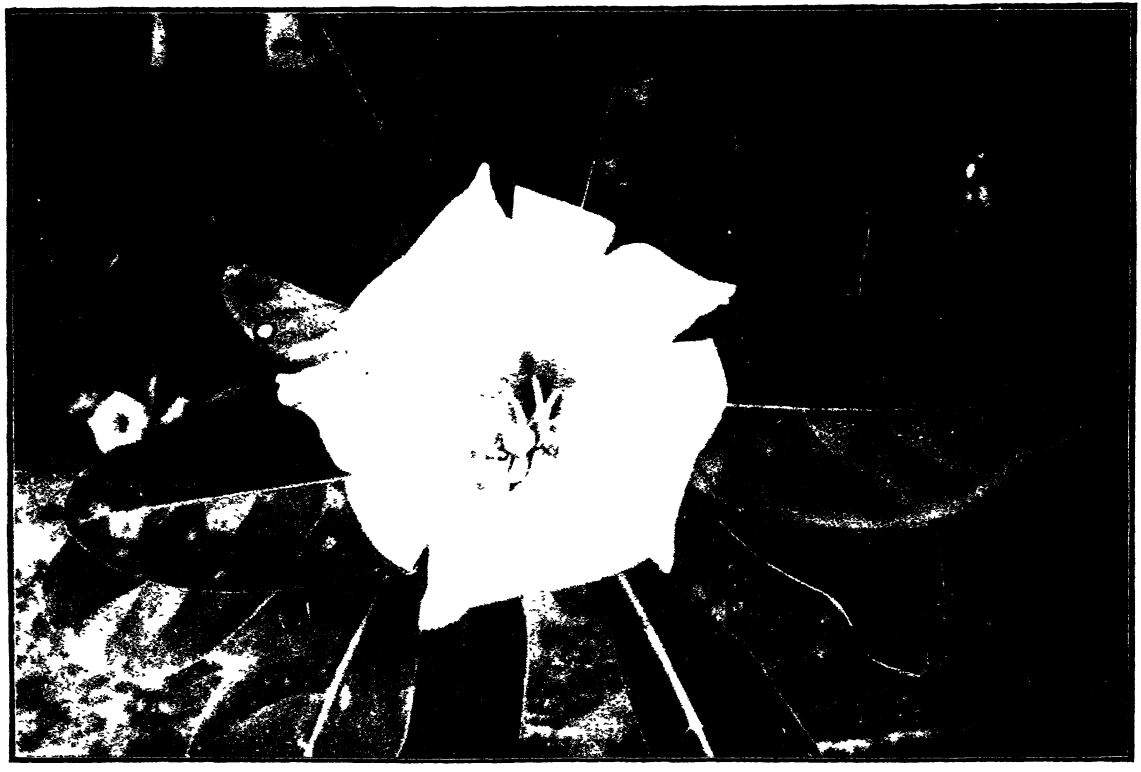
This species, introduced in 1933, promises to be one of the most useful of recent discoveries of ornamental annuals for Malayan gardens. It is that rare thing, a robust plant with really fine bright blue flowers. Plants are grown easily from seeds, and thrive either in pots or garden beds. They grow to a height of about a foot, and when in full flower each plant is a pyramidal mass of forget-me-not blue. To complete its virtues, the species produces seeds quite freely in Singapore. Its one disadvantage is the short period during which the plants are at their best.

The flowers are very much like Forget-me-not (Myosotis) in appearance, but instead of the lax spreading habit of the common Forget-me-not, this Anchusa has a compact erect habit, tapering upwards from the basal rosette of rather large simple leaves. The central stem bears numerous side branches, all floriferous.

The species is native of the Caucasus, and a large form was reported from Siberia. It has been known for over 100 years, but seems to have been little cultivated, and is not offered in the ordinary European nurserymen's catalogues. It may perhaps have been used for the production of hybrids, but we have no information on this point. It receives no more than a bare mention among the less cultivated species in Bailey's Cyclopaedia of Horticulture.

The species is referred to as a perennial, but it appears probable that we shall do well to treat it as an annual in Malaya. It produces sufficient seeds to provide easily for a succession of plants; it can also be propagated from cuttings.

We owe our introduction to this delightful plant to the kindness of Mr. H. Huebner of Groton, Mass., U.S.A., who visited Singapore about two years ago, and sent us seeds after his return to America. We ought evidently to try other kinds of Anchusa, especially the lesser known species, and also to cross them with *A. myosotidiflora*. R. E. HOLTTUM.



Fagræa Auriculta: Flower with withered stamens and expanded stigma.

MISCELLANEOUS NOTES.

Sweet Peas in Johore.

Mr. A. M. Dick of Tai Tak Estate sends the following note about a successful attempt to raise sweet peas to flowering in Johore.

" Firstly, the pea seeds were sown half a inch below the surface in a tub containing about one foot of earth, boiling water having been poured over the soil previously to eliminate live matter destructive to seeds, and were spaced at nine inches. A sack was placed over the tub, watering was done every morning about 6.0 a.m., and a 30 per cent. germination was obtained within seven days.

" The sacking was removed and watering continued as before. When the plants were tall enough they were tied to bamboo stakes about four feet in height and in about three to four months blooms appeared when the plants were about four feet high. I may mention that, though the packet of Yates' seed showed that it contained pink, red, purple and white peas, it was rather curious that the blooms were either white or purple! These blooms had the pleasant perfume of " Home " sweet peas and lasted fresh about three days.

" Factors, which perhaps attended the obtaining of the blooms were, that the tub was placed between the side of my bungalow and a jacaranda tree, and only received about five minutes sun each day; also the careful attention during germination."

Dhalias from Seed.

The variety chosen was Sutton's Giant Decorative. All compost used was sterilised. The seeds freshly arrived from England were sown in fairly light well drained compost firmly pressed down, and were only first covered with soil which again was pressed down firmly and evenly. The seed pan used was covered with glass and kept in a light but shady place. After germination was established, the glass was removed and a few days later the pan was moved into full sunlight but shaded from rain and sun during the hottest part of the day. The seedlings were later transplanted singly into 4" pots and when established were watered weekly with a dilute solution of " Supram." Growth was continued in full sunlight in the 4" pots until the plants were sturdy and the pots fairly full of roots. Seedlings which got leggy were stopped back to just above the first pair of real leaves. The final shift was made into 10" pots, filled with 3" broken crocks and sand at the bottom. The compost used was composed of leaf mould 3 parts, old potting soil 1 part, sand 1 part, all sterilised. Plants were grown on in full sunlight and watered occasionally with dilute " Supram." Of the 27 seedlings which germinated, 20 eventually produced fine flowers of good and varied colour in equal proportions of double, semi-double and single varieties. The plants continued a longer term in flower, were more floriferous, and more compact than plants usually grown from tubers of the decorative variety.

E. D. B.

Miscellaneous.

THE CONTROL OF RURAL MALARIA

BY

K. B. WILLIAMSON, M.A., & DIPLOMA AGRICULTURE (CANTAB), D.I.C.

(Formerly Malaria Research Officer F.M.S. and recently in charge of Anti-malarial investigations Cameron Highlands).

(Continued from p. 228 Vol. iv No. 1 January 1934)

Methods based upon Processes of Natural Control.

Herbage cover—*(Contd.)*

This method by a single operation, namely packing green herbage tightly over and into shallow water, brings three influences to bear on it, each of which is by itself able to restrict greatly, and usually to prevent, the breeding of species such as *A. maculatus* which require light and at least fairly pure water in their breeding places. It

(1) creates an almost or quite impenetrable barrier for adult mosquitoes.

(2) densely shades the water.

(3) causes harmful biochemical changes in it due to the rotting of green vegetation in the prescence of too little air.

(4) produces a dark-coloured and fertile deposit of soil when the cover is maintained for three or four months, with the result that a dense crop of weeds is liable to grow up, which gives more or less permanent shade. The alteration in the character of the soil also probably discourages the breeding of *A. maculatus*, since this species usually breeds in places where the soil contains very little organic matter.

Among malaria carrying anophelines, the shade factor is inoperative against *A. umbrosus*. The effiency of concentrated rot is to be inferred from its having been effective in ponds, and from experiment in the laboratory where newly hatched larvae of *A. maculatus* all died within a couple of days when placed in foul water from a bowl in which grass had been rotted for about three months. This proves that the effects of rotting vegetation are long lasting when the products of decay are not diluted or washed away. It also probable that the rot acts in another way by deterring females bent upon egg-laying from doing so. There is indeed good reason for believing that the senses of mosquitoes are keener than our own. How else are females of *A. maculatus* for example able on dark nights to select with almost unerring accuracy the springs and seepages in which they lay their eggs?

It is to be remarked that the effects of rot, whether in the soil or

water, are most harmful when it occurs in the absence of air, or with too little present, since oxygen derived from the air (or produced by the action of green water—(or other) plants in sunlight) is the great purifying agent in nature. The biochemical effiency of the rot occurring in shallow stagnant water, crammed, as it is, full of decaying vegetation, and sheltered from light and wind under a cover of cut herbage is therefore about the greatest possible, and it far exceeds the minimum necessary for checking breeding.

The fact provides a conclusive refutation of the argument that methods of mosquito-control based upon biochemical changes should not be practically applied until the exact equivalents and quantities concerned have been ascertained and tabulated to the last decimal.

But the biochemical factor in control may be negligible in running water, even when it is covered with herbage, and any holes which may form in the cover should therefore be carefully filled at weekly or ten-day intervals.

Finally it is important that a considerable proportion of the cover used should be green, since the patrescible proteins or albaminoids (a form of so-called organic nitrogen) which are present in living tissues are almost entirely absent from dead leaves and dry twigs, and the woody fibres present in these decompose much more slowly and with more doubtful effectiveness.

Biochemical control through the soil and agriculture.

There is growing evidence that the chemical constitution of the soil is important indetermining the distribution of malaria, and of the species of anophelines which carry it. The immunity enjoyed by the coastal rice belt in Malaya is related to a high content of organic matter, including organic nitrogen, in its soils, coupled with imperfect drainage, which, by leaving the land water logged even in the fallow season, causes the decay of dead vegetable (as well as animal) matter to take place in the soil in the absence of air. It is significant that in this tract of country *A. maculatus* occurs pratically only where isolated granite hills, like the ones at Jugra and Kuala Selangor, bring pure springs derived from and based upon mineralised soils poor in organic matter, to the surface. And as the history of Jugra shows, the vicinity of these hills is often very malarious.

The interest of the subject in reference to the control of rural malaria lies in the fact that as shown by Mr. Charlton Maxwell by examples from various parts, the world in his book on Malaria Control, (Published by Messrs Kyle, Palmer & Co., Ltd., Kuala Lumpur, price $1/-) intensive agriculture, which enriches the soil, generally leads to a great diminution of malaria, and sometimes to its virtual extinction, as in England. The direct and indirect influence of cattle and pigs, which both contaminate and fertilise the soil, and attract mosquitoes away from man, is important in this connection. Incomplete drainage also may as in the case of our coastal soils sometimes be an important factor in effecting the control of malaria if it leads to water logging, and the growth of leguminous crops should, at least under these conditions, and in proportion as the organic nitrogen which

they add to the soil is retained in it, to a greater or lesser degree act as a preventive of malaria.

The keeping of pigs in the Island of Pankor is said to have greatly reduced its incidence there, and it is probable that the pollution caused by the curing of fish has also materially helped to produce this result.

But what is agriculturally sound practice does not always diminish malaria. Irrigation for example, which does little or no harm on the organically rich paddi soil of Krian, is productive of a great deal of malaria on the poorer mineral soils of the Sudan and the Punjab. Taken as a whole the facts point to the conclusion that any long range policy for diminishing rural malaria should aim at enriching the soil by encouraging intensive agriculture, while at the same time increasing the number of cattle and pigs on the land. This should lead not only to decreased risk of infection, partly brought about by better housing due to increased prosperity; but the people, being better nourished, will be better able to resist attacks of malaria. This policy, known by the uncouth name of *bonification*, borrowed from the Italian, has led to a notable decrease of sickness in many places in Italy. Cattle tend to attract mosquitoes away from man, but the effect upon the soil of their dung is also probably sometimes important.

Biological Control in Fish Ponds.

We have so far chiefly considered control effected by biochemical changes brought about by the bacteria and other micro-organisms which cause decay. More varied biological control, to which fish, predatory water-insects, and water-plants contribute, is possible, and is sometimes necessary, in fish ponds. Owing to their pollution most carp ponds probably cause little or no malaria; but they not infrequently are a serious nuisance owing to non-malarial mosquitoes breeding in them. Carp being vegetable and refuse feeders do little or nothing to diminish this nuisance. When the corruption in the ponds is not too great, larvae-eating fish, such as *Panchax* (the little fish with a white spot on its nose) can be very useful, but hardly any attempts are made to breed them in these ponds. Certain water insects like water-boatmen, and the large active water bugs (so classified because they suck the juices of their prey) are also extremely destructive to larvae. And water plants such as water lilies and duck weed, by covering up the surface of the water, sometimes leave very little of it free for larvae. The common yellow-flowered bladder-worts are moreover able to capture and kill larvae in their numberless traps which their bladders form, and which serve the plants as stomachs. Very few larvae however are so captured and the rotting of dead fronds of these and other plants, such as the stone-worts (*Characeal*) is often more effective.

But generally speaking none of these agencies can be relied upon singly to abolish mosquito-breeding completely. Wisdom lies in setting as many of them at work as the particular conditions will permit. In this way the desired end of completely abolishing all mosquito-breeding for a period of

about two years during which the observations lasted, was attained in the carp ponds constructed at Tanah Rata; and a further investigation of them by specialists might throw more light upon the complicated causes which led to this result, and so prove useful elsewhere.

In one respect the experiment was critical. Contrary to anticipation it was found possible to check the breeding of *A. maculatus* completed by biochemical means alone in several of the ponds where the concentration of rotted grass and herbage was greatest, although an average of about ten thousand gallons of water continued to run through them daily. This fact provides convincing proof that the same result can be obtained with ease and certainty in stagnant water. More than twenty years have passed since Sir Malcolm Watson prophesied that the rotting of vegetation would provide a solution of this country's rural malaria problem, and anticipated the time when current anti-malarial procedure would seem like burning the house down in order to cook the pig ; but nothing has been done to give practical effect to his wisdom.

Need for Combined Operations.

The example we have considered shows how natural control lends itself to the combination of a variety of effective causes which operate together and reinforce one another.

The method of herbage cover provides a striking and beautiful illustration, for by a single operation it brings into play the controlling influences of a mechanical barrier, shade, and biochemical change. The principle is however capable of extension and more deliberate application. Steps should be taken deliberately to set as many controlling influences as possible at work in the same place, and to apply different methods in different places, even though they may be close together. This is already done when, for example, part of an area to be controlled is drained dry and the remainder is oiled. But a great deal more might be done in the way of varying the methods in use, especially by making more use than at present of simple and cheap natural methods of control.

If any method, however, whether oiling sluicing, or any other is pushed to extremes and applied in places to which it is not suited it becomes expensive.

What the economists call the law of diminishing returns comes into operation. Correct judgment in applying anti-malarial methods is therefore quite as important as the methods themselves. Only a few examples of these principles can be given here. Others will suggest themselves to the reader, and in the course of work:—

(a) Combined Control in a Single Breeding Place.

1. The growth of shade plants should be encouraged so as to provide permanent protection against *A. maculatus*, no matter what other means of control are in temporary use. Sluiced channels lend themselves to this procedure since flushes of water, unlike oil,

usually do not damage, but rather encourage the growth of vegetation.

2. Varied biological effectives including fish, water insects, water plants and biochemical factors should, as has been seen, be made to work together to establish permanent control in ponds.
3. Fish ponds should everywhere be established at the heads and along the course of the dangerous irrigation channels (*jalan ayers*) in hill rice valleys; and should be used to sluice the channels. The emptying out weekly (effected through suitable screens and nets which retain the fish) of most of the water in the ponds should in itself greatly reduce the risks from mosquito breeding, and costs should be more than recovered from the yields of fish, and the increased economic energy of the cultivators, resulting from more nourishing diet, decreased infection from, and greater resistance to, malaria. The irrigation channels themselves should be emptied and dried whenever possible.
4. Other sluiced channels elsewhere should whenever necessary and possible be polluted from factory refuse or from the soap from bathing pools and laundries etc. They might perhaps be used as a means of distributing small quantities of oil to danger spots at which obstructions diverted the oil (as well as soap etc.) to pools and seepages at the sides of the channels.
   The idea that anti-malarial practice should be made the sport of rival methods and factions is clearly foolish and harmful.

b) Varied Control in a Single area.

Correct procedure often varies from yard to yard. In a single small area for example there may be:—*ravines*, best left shaded, but if cleared, requiring oiling, sluicing etc., according to their size and particular circumstances: *diffused seepages*, requiring to be channeled if they cannot be drained dry, small channels being sluiced, or they, and small pools being covered with herbage, stones and earth etc. In a case reported by Dr. Wolfe from Kuala Kangsar it was possible to deal effectively, by a cover of herbage without damage to the crop, with a drain leading to a rice field where *A. maculatus* was breeding: *Ponds*, to be dealt with as above indicated: and *dead water* in stagnant ditches and pools, and water logged marshes etc., where no anopheline mosquitoes breed, and which are usually indicated to the eye by dull brown water and the presence of brown scums of iron. Natural biochemical control is completely effective in these dead water situations and, until they can be drained, these spots only need to be kept under observation. They sometimes form a large part of a supervised area, and the practice of promiscuously oiling them is wasteful and productive of no good.

Wide Range of Effectiveness of Biochemical Influences.

The foregoing summary has made it clear that, contrary to popular

opinion, water itself is, or may be made, an influence restricting mosquito-breeding. In fact it is not an overstatement of the truth to say that most kinds of water are unsuited to the needs of most species of mosquitoes, and that Nature restricts particular species to a more or less narrow range of breeding places. Apart from sunlight and shade, the most widely effective of her instruments are the biochemical changes brought about by micro-organisms. These are operative everywhere, and the controlling influence they exert, either upon mosquitoes in general, or upon particular species, extends to every kind of water. The number of breeding places they put out of bounds for malaria-carrying anophelines in general is very great indeed, and for particular species still greater. The effectiveness of biochemical influences due to the bacteria in soil and water is far greater than that of all other biological agents including larvae-eating fish, although being easily seen at work, these attract more popular attention. To take the most familiar, example, which in this country is also the most important one, fish are entirely absent both from the surface pools which *A. maculatus* avoids, and from the seepages it selects; and few predatory insects are to be found in either. But almost all those that there are, are present in the water which are the nurseries of its larvae, and not in those from which they are absent.

Methods based upon the Movement of Water.

It remains to review very briefly the not inconsiderable possibilities of control offered by the dynamic effectiveness of water in motion.

1. **Agitation of the Water Surface.**

Mosquito-larvae are frightened from feeding, and they, as well as pupae cannot breathe the air they need, when the water they are in is agitated. Moreover since all anopheline, and most culicine, mosquitoes lay their eggs actually on the water they require it to be still. In accordance with these facts larvae and pupae are not to be found in water which is much troubled by wind or waves. Artificial agitation therefore suggests itself as a promising means of preventing breeding in small accumulations of water when circumstances rule out other methods of control such as oiling or pollution; and the method might be applied even in ponds where water power, such as might be provided by their outfall, is available. Models of agitators based on this idea were exhibited by Dr. Jacques and myself at the last two annual exhibitions of the M.A.H.A. but full-sized constructions have not so far been tested in actual breeding places. A few observations made by Dr. Scharff and myself however go to show that where water splashes, or is sprayed, on to gardeners' pools, larvae will not appear within a few yards of the disturbance. *A. maculatus* very commonly breeds freely in these ponds, which cannot be oiled, and the whole subject offers a promising field for contriving and constructive ingenuity and experimental investigation.

2. **Antimalarial sluicing.**

Results in the Highlands.

This method proved completely effective both in small and medium sized ravines in the Cameron Highlands, as well as in quite flat drainage channels about a yard in width. It fact no larvae were ever found below sluice gates in the sluiced channels after one or two flushes had run through them. This is the more surprising since there as elsewhere small larvae commonly appeared in oiled channels (outside the un-oiled main experimental area, which was at Tanah Rata) between oiling intervals. The method therefore proved superior to oiling, a fact difficult to account for, but which may possibly be explained by disturbance of the soil in the beds of the channels having altered the properties of the water in them, and rendered it repugnant to egg laying females. A dense growth of algae in most of the sluiced channels, subsequent to sluicing being started, supports the view that some significant change was produced by it. The fact that no larvae were found in the channels, some of which were under regular observation for about two years, disposes of the fear that under these conditions they might be washed away and presented as living sacrifices to neighbours at lower levels. Evidence from fragments of match stick showed that many larvae must get stranded at the sides both of grassy drains, and of ravine beds. Where the fish was spread out, as occurred at the foot of one of the ravines where there was a flat expansion the tendency to stranding was even greater. This suggests that shallow expansions placed at intervals along the course of flat drains might sometimes increase the effectiveness of flushes.

In addition to sluice gates opened once or twice weekly by hand, automatic tippers discharging rather less than four and sixty gallons respectively at frequent intervals, day and night, were tested. They were designed, and the original models were made by Mr. J. P. K. Wilkins, and, though difficult to keep in order, they proved completely effective in narrow artificial channels. The larger tippers when tested in small incompletely canalised shaded, ravines in the lower Highlands, though manifestly discharging too little water, gave exactly the same counts of larvae, as similar ravines did when were oiled.

Applicability and Costs of Sluicing.

The trend and emphasis of the foregoing argument will have made it clear that neither sluicing nor any other anti-malarial procedure is of universal application. Like every other method of larval control it is subject to the law of diminishing returns, and it is cheapest and most effective in small channels. It is particularly suitable for dealing with

A. maculatus in the majority of its natural breeding places, like small springs and seepages, when they contain flowing water, the seepages requiring to be canalised. The costs of constructing and setting sluice gates, and of constructing reservoirs to serve them rises in considerably higher ratio than the breadth of the water channels to be sluiced, and there are actually many more larvae to every ten yards of small trickles of water, than are found in large streams, where breeding places are often restricted to side pools separated by half a mile or so if they occur at all. Most of the sluice gates used were built in the laboratory at a cost in material, (which consisted of small ten cent packing cases and hard vulcanised sheet rubber, wire and hinges), of a dollar, more or less; and they lasted with occasional repairs for a year or more. Cheap but more solid wooden sluice gates constructed on a similar principle were also used, and when made of steel they cost only about four dollars. Sluicing carried out in this way is very cheap, and after channels and reservoirs have been dug, very little labour is needed to operate and maintain the sluices. It is also the only possible method of dealing with ravines emcumbered by cut timber which renders their water inaccessible to oiling.

Future Developments of Sluicing.

Enough has been said to show that the natural but somewhat crude idea that the effectiveness of sluicing is entirely, or even mainly, due to larvae being washed away by the current is not always true. Frequent small automatic disturbances of the water level may prove as effective as violent floods, produced by the sudden discharge of large volumes of water: with attendant risk of erosion where the side of the channels are soft. On the other hand large flushes may be needed in large channels. They cannot be produced automatically by tipping devices, owing to the necessarily very limited size of tippers. Automatic discharge from reservoirs of large size is needed.

Apparatus without complications of pulleys or levers, and giving large or small, immediate or defferred, flushes, and worked entirely by water power (one form of which, made from bamboo pipes and rubber sheet, might be constructed without difficulty in kampongs) was designed and tested in the laboratory. But owing to the interruption of my work before final experiments could be made, at a time when progress was most rapid, it has not yet been possible to test the effectiveness of these contrivances for actually controlling breeding.

Rural Subsoil Drainage.

When it is effective, sub-soil drainage, besides conferring automatic immumity from mosquito-breeding, is productive of gain, since it increases the fertility of garden and field soils in cultivable areas, and raises the rental of urban building land. But, as ordinarily practised, its costs are prohibitive in rural districts, except when money from general revenues is poured into small rural areas, as has been the case in rural Singapore and Penang.

Great technical skill is also needed in the laying of the pipes used, and in maintaining them in working order; and they very often become blocked with solid masses of roots. Particular interest therefore attaches to methods of sub-soil drainage which give less opportunity for blockage by roots, and which make use only of locally available material obtainable free. Whichever of the following methods is used *the drains must be covered with tightly packed earth, preferably clay*:—. The following alternatives are available:—

1. *Stone or rubble drains.* Like the following method this is an old and very effective method of agricultural drainage, too little used in anti-malarial work. Stones are however not always obtainable, and in one way or another are liable to be costly.
2. *Ordinary brush-wood drains.* In Great Britain they have been known to last for fifteen or twenty years, but this could not be hoped for in the tropics.
3. *Mole-plough drains.* These consist of earth tubes made in stiff clay soil, and can only be constructed when this is present, and a powerful tractor is available. The method is being tested by Mr. Sands at the Alor Star aerodrome.
4. *Dr. Struthers' and Dr. Wolfe's bamboo-pipe drains.* These are proving successful respectively in Pahang and Perak.
5. *Dr. Waugh Scott's lalang and stick drains.* Since this article was in the press I have been privileged to to be shown by himself the original and important development he has made in estates near Sungei Siput. I was also shown herbage-covered drains which had remained effective up to one year, with only one renewal of herbage. Sub-soiling however is likely to be more permanent, and therefore more useful. The drains are made by placing thin sticks two feet or so in length, lengthwise in the drains, to a height of a foot or more. These are then thatched with tufts of lalang, several inches in thickness, and earth, preferable clay is packed over the lalang, so as to leave a channel for storm water. The method is proving very effective in flat drains up to two or three yards in width. Brown and scummy water is to be seen below some of the covers, indicating that controlling biochemical influences are at work even in gently running water. They probably have their origin in the rotting of the lalang under conditions which completely exclude air, but its main function is to act as a filter, to keep the spaces between the sticks free from silt, which might otherwise be washed through the covering earth and tend to block the drains. A particularly important subsidiary feature of the method is that side seepages in and near the banks of the drains, up to two or three yards in diameter, are covered in a similar way, the sticks being laid so as to slope downwards when seepages half way up the banks have

to be dealt with. In one estate the whole of the work had been done by only two " oiling " coolies, who are in danger of failing to justify their honourary title. Therefore the work has been done at no extra cost, and there is a monthly saving of oil, and avoidance of the risks which always exist that oiling may not be carried out efficiently. Since sticks (or brush-wood) are obtainable everywhere, even more easily than bamboo pipes, and call for less care and labour to prepare and to lay them, this method promises to be remarkably helpful and deserves wide trial in kampongs and estates. When medical health officers are proving the usefulness of simple methods such as this and that of bamboo-piping there can be no reason why they should not be applied to the saving of life far beyond the possible range of their personal control.

Conclusion and Summary.

We have seen that the special suitability of natural methods of control to rural conditions lies in the fact that they make use only of material obtainable everywhere free of cost throughout the country, namely its soil and vegetation, and the water itself in which mosquitoes breed. Natural methods of control are not inferior to artificial ones like oiling. On the contrary they provide long lasting, and in some cases permanent, immunity. The rural problem is not the problem of estates and Sanitary Board areas, where effective control of malaria has already been attained by older methods applied with throughness and skill. Their partial supersession by natural methods is entirely a matter for the personal judgment of those in responsible charge of these areas, to whom the public owes a debt which it inadequately appreciates. It is however reasonable to expect that those responsible should be given and avail themselves of facilities for becoming acquainted with tried new methods; and should be provided with the appliances they need in order to apply them. In these respects the organisation of anti-malarial work lags far behind that of the fighting services, with their numerous schools of instruction, and departments of supply and ordnance, which teach the use of new weapons, and make them available. But the malaria-carrying mosquito is a subtle, and, over most of the area of this and every other country, an unchallenged and deadly foe, The reader need not be reminded that malaria is still the chief cause of mortality in Malaya. Almost all of this occurs in uncontrolled areas. But this is far from being the whole story. Malaria is not usually a quickly fatal disease. The economic loss it occasions through sickness is disproportionate to the deaths it causes, and has been estimated at between fifty and sixty millions sterling annually for the British Empire. Malaya is one of the most malarious countries in the world, and her position is particularly serious, because, while she needs to grow much more of her food than at present, malaria exacts a heavy toll from the land already

cultivated, and hems it in, and checks agricultural expansion. This is mainly, though not entirely, due to the ravages of *A. maculatus*, which for some unexplained reason is more virulent here than in other countries, But it has not been heretofore realised that, since it usually breeds in very little water, which is often running, it is particularly easy to eradicate from at least a large proportion of its natural breeding places by simple methods such as vegetable pollution, herbage cover, sluicing and cheap sub-soiling.

Nothing worth while however can be achieved without a determined effort to organise the villagers to help themselves on some such lines as were sketched in the first of these articles. Medical men are too few and too much needed elsewhere to do the work alone. It can only be carried through by the co-operation in an enlightened policy of Administrative, Educational, Agricultural and other officers, high and low. The immediate need is to demonstrate the possibility of villagers with the necessary instruction and supervision, combatting and controlling malaria in a few selected kampongs and their surroundings. Nothing, and no where else will do. Co-operative Societies, Schools, training colleges, and village school masters can help in the good work.

In these non-technical articles, while endeavouring to do justice to all concerned, and to every method, I have stated my reasoned conviction that there is both great need for the long overdue application in the fight against malaria of methods of natural control, in the investigation of which Malaya has been a pioneer, and also great hope in applying them fearlessly and without prejudice, especially in the country's large uncontrolled rural areas, where they offer the only practicable remedy. In working for this end, while urging pursuance of the wise and beneficent, but now perhaps forgotten policy which would achieve it, I am only continuing what I was chosen, and brought to Malaya, to do.

Erratum—Vol. IV, No. 1, page 227, last line:—After " form in it " insert " are needed, and a necessary precaution in the "

The Malayan Agri-Horticultural Association.

Annual General Meeting.

The Annual General Meeting of the Association was held on the 29th March, 1934 at the Secretary's Office, 12, Barrack Road, Kuala Lumpur. Mr. F. W. Douglas, President of the Association, took the Chair.

Accounts. On the proposal of Mr. L. Y. Swee, seconded by Mr. Pat Zilwa, the meeting adopted the Balance Sheet and Accounts for the year 1933.

President's Report. In his review of the past year, the President, Mr. F. W. Douglas spoke as follows:—

"Though the year's accounts show a reduced excess of income over expenditure, yet there are some factors which give us hope that we have turned the corner in the matter of our Exhibition.

The first is the increased interest now being taken all over the country in agricultural shows and we hear of the revival of Branches of the Association being considered once more.

The next is that the trade exhibitors are showing signs of interest in advertising their businesses.

The worst feature of the accounts is the accumulation of arrears of interest which we cannot pay. It is unfortunate but we must admit this and see if our debenture holders will meet us.

The running track was used for the Selangor A.A.A. Sports, the Police Sports and the Chinese Malayan Olympiad. It is used regularly by young men training and is, I believe, the only permanent running track in Malaya.

A noteworthy event of the year was the re-issue of our Magazine. There is no doubt that this is increasing the general interest in the work of the Association; it is also the official organ of the Selangor Gardening Society.

The scheme of Malayan Hampers met with a great response and we have had many delightful letters from the recipients. For both of these, we have to thank our Secretary, Mr. Barnett.

A Badminton Club is now using part of our main building and paying us a small rent. The building is certainly admirably suited for it.

The Committee have considered a scheme for a reduction of the annual subscription to $2/- and this will be placed before you to-night. The Committee think that a special effort should be made to recruit an increased membership."

Office Bearers.

Mr. F. W. Douglas was unanimously re-elected President and it was decided to invite the following to become office bearers for 1934.

VICE PRESIDENTS:— The Hon'ble the Director of Agriculture, S.S. & F.M.S., (Dr. H. A. Tempany, C.B.E.), *ex officio*, The Hon'ble The Raja Muda of Perak, M.F.C., Mr. John Hands, M.C.H., The Hon'ble The Undang of Rembau, M.F.C., The Hon'ble Mr. Lai Tet Loke, M.F.C., The Hon'ble The Raja Uda, M.F.C.

GENERAL COMMITTEE:—Messrs. Goh Hock Huat, E. D. Butler, L. Y. Swee, C. van Dort, S. C. Colomb, Pat Zilwa, V. L. Cachemaille, E. W. Cooke, J. Lambourne, F. W. South, D. H. Grist, S. G. Sollis, W. D. Mavor, J. L. Ross, B. Bunting and A. L. Shelton-Palmer.

STADIUM COMMITTEE:— Messrs. John Hands, J. L. Ross and W. D. Mavor.

AUDITORS:— Messrs. Walter Grenier & Co. were re-elected Auditors for the year 1934.

Amendment of the Rules. Rules 4, 7 and 8 of the Association were revised, providing for the reduction of the annual subscription from $6/- to $2/- and Life Membership from $50/- to $20/-, the deletion of the Associate class of membership and for the conferring of membership upon application on the prescribed form and payment of the annual subscription.

The meeting terminated at 7.30 p.m. with a vote of thanks to the Chair.

The Eleventh Malayan Exhibition.

As already announced, the annual Malayan Exhibition will be held this year on the 2nd, 3rd and 4th June, 1934 and organisation is now well in hand.

The Trade Section, as anticipated, will require considerably more space than in 1933, and it has been decided to house the Village Industries Section in a separate large attap building, providing incidentally at least a further 2,000 square feet of floor space for that Section.

Adopting again last year's plan, all buildings will be linked up so that it will be possible to inspect all Sections without leaving cover should there be rain.

The Agricultural Section will again branch off to the left from the entrance, the Poultry and Horticultural Sections both branching off at right angles, parallel to each other and to the main building, hollow rectangles being formed between the three buildings to provide for air passages.

The two latter Sections lead into the Village Industries Section which again in turn connects up with the far end of the main building, where also will be situated the principal restaurant on the same site as last year.

The Agricultural Department and Rubber Research Institute will stage

their usual exhibits in their own building and the Health Department will also give displays and talks on public hygiene. The Health Department also in conjunction with the Co-operative Societies Department will give free Cinema shows as in former years.

The Selangor Football Association have promised their help in arranging for a knock-out football competition between important local teams, semi-finals to be played on Saturday and Sunday and the Final on Monday. the last day of the Exhibition. Entrance to all matches will be free to visitors. Bicycle races will also probably be run in the Stadium at night and other popular forms of amusement are being planned.

Schedules are now available for all Sections and can be obtained from the Secretary, 12, Barrack Road, Kuala Lumpur or from the following Honorary Section Secretaries:—

Agriculture - - -	R. B. Jagoe Esq., Dept. of Agriculture, K.L.
Oils and Fats - - -	Gunn Lay Teck Esq., Dept. of Agric. K.L.
Preserves & Confectionery -	Mrs. R. E. Cox, c/o. Girl Guides Association, Hongkong & Shanghai Bank Buildings, K. Lumpur.
Horticulture - - -	Mrs. R. P. N. Napper, 186 Ampang Road, K.L.
Poultry - - - -	A. L. Shelton-Palmer Esq., Abaco Estate, Semenyih.
Cats - - -	Mrs. A. L. Shelton-Palmer, Semenyih.
Needlecraft & Handwork -	Mrs. M. Dukes, c/o. Y.W.C.A., K.L.
Needlecraft & Handwork (Sewing Machine Section)	Mrs. E. P. Hodgkin, 634 Circular Road, K.L.
Schools - - - -	Inspector of Schools, Selangor, K.L.
Village Industries - -	Inche Patek Akhir and Inche Hussein, Co-operative Dept., K. L.
Art and Photographic - -	E. P. Hodgkin Esq., 634 Circular Road, K.L.
Pigs - - - -	V. L. Cachemaille Esq., c/o. 12, Barrack Road, K.L.

Selangor Gardening Society.

Flower Show.

The first half-yearly Flower Show was held at the Race-course on Saturday, 17th February, by kind permission of the Selangor Turf Club.

A large number of entries was received and the standard of exhibits was most satisfactory. As the Committee had hoped when fixing the date of the Show, the weather was ideal, and the Show was well attended.

The outstanding exhibits were a collection of cut flowers and some very fine gloxinias grown by Mrs. H. G. Harris. The chrysanthemums exhibited by Mr. Chew Tze Foong were also of special merit.

In class 7b the Judges were faced with quite a serious problem in allocating the first and second prizes. At least half a dozen entries deserved a first prize. The snapdragons exhibited by Mrs. Knight and the roses grown by Mrs. Arbuthnott compared most favourably with similar varieties grown in England.

A small but choice collection of hill-grown cut flowers was brought by Mr. H. B. Wilkinson from his garden at Ginting Simpah.

The magnificent display of pot plants from the Lake Gardens was much admired by all and highly commended by the Judges, Mr. C. van Dort and Mr. J. Lambourne.

The following is a complete list of prize winners:—

Class.	Description.	1st. Prize.	2nd. Prize.
1	Miniature garden.	Mrs. R. P. N. Napper.	Mr. B. S. Mee.
2a	Specimen flowering plant in bloom.	Mr. Chew Tze Foong.	Mr. H. Hampshire.
4	Collection of flowering plants.	Mrs. H. G. Harris.	Mrs. L. G. Corney.
5a	Orchid, terrestial, specimen plant in bloom.	Mr. J. N. Milsum.	Mrs. Mungo Park.
5b	Orchid, epiphytic, specimen plant in bloom.	Mr. C. R. Thurstan.	Mrs. V. H. Winson.
6a	Specimen ferns.	Mr. E. D. Butler.	Mr. C. R. Thurstan.
6c	Group of foliage plants.	Mrs. V. H. Winson.	Mr. E. D. Butler.
7a	Collection of cut flowers.	Mrs. H. G. Harris.	Mr. E. D. Butler.
7b	Single vase of cut flowers.	Mrs. R. Knight.	Mrs. A. Arbuthnott.
7c	Collection of cut Cannas.		Mrs. H. G. Harris.
8a	New introduction to local horticulture, (flowering plant).	Mr. E. D. Butler.	Mrs. C. C. Sharp.
8b	New introduction to local horticulture, (foliage plant).		Mr. S. C. Colomb.
9b	Lettuces.	Mrs. L. G. Corney.	Mrs. L. A. McGowan.
9c	Other vegetable.	Mrs. J. H. Harris.	Malay School, Ulu Langat.
10a	Produce of Malay school garden.	Malay School, B. Badong.	
10b	Produce of Malay schoolboy's home garden.	Ahmad bin Abdul Hamid, (Sch. Jeram Pantai).	Jajeri bin Bakeri), (Sch. Assam Jawa).

M. E. N.

THE

M.A.H.A. MAGAZINE

(The Official Organ of the Malayan Agri-Horticultural Association, and of the Selangor Gardening Society.)

Vol. IV. JULY, 1934. No. 3.

THE
M.A.H.A. MAGAZINE

JULY, 1934.

EDITORIAL.

We think it can be justly claimed that the recent Malayan Exhibition, of which a report appears in this issue, once again proved the value of such Shows in Malaya.

The fact that this year the Exhibition was still larger than last year, appears to us in itself to confirm this view, showing as it does the constantly increasing interest taken in the competitive sections which correspondingly should imply improvement in the subjects under competition.

The All-Malayan Padi Competition, which came to a successful conclusion at the Exhibition, represents an important advance in dealing adequately with the more important of the agricultural products of Malaya on a competitive basis. As will be seen from the separate report published in this issue, one direct result of this competition has been to stimulate interest in padi cultivation in Kedah with a view to participation next year.

The general all-round improvement in conditions in Malaya was particularly reflected in the Trade Section and we imagine that those firms which considered increased expenditure on advertising unjustified must subsequently have regretted their decision.

A report of the Exhibition appearing in the *Malayan Agricultural Journal* for June, comments on the failure of horticultural cultivators to avail themselves of the opportunity for advertisement presented by the Exhibition. The report points out that the value of imports of flowers into Malaya has dropped from nearly $20,000 in 1931 to a little over $6,000 in 1933, and that there is no reason why this country should not entirely satisfy the present demand, while it is possible that the local demand could be increased.

We commend these views to local and hill station cultivators and shall hope to see a really representative professional display at next year's Exhibition.

Small-Holders' Rubber.

For the past three annual Exhibitions, rubber has been excluded from the competitive sections as it was felt that its inclusion would not serve any useful purpose in view of the general high-grade rubber now produced by estates.

The position has altered somewhat, however, in view of the inauguration of a service of Asiatic rubber instructors for the improvement of the cultivation and produce of small rubber-holdings.

As will be seen from the report of the Exhibition, the Chief Secretary suggested, in his opening speech, the re-introduction of competitions for smallholders' rubber on the basis of the All-Malayan Padi Competition, this method of competition having proved definitely successful.

We understand that this question has since been discussed at a conference of Field Officers of the Department of Agriculture and has been referred to the committee of the Malayan Agri-Horticultural Association for their consideration.

Membership.

We regret to report that the results of the campaign for increased membership of the Malayan Agri-Horticultural Association fell short of expectations, although the number of new life members recruited was satisfactory.

The annual subscription of $2 is not a large sum to contribute towards the support of a public body which definitely plays its part in the agricultural affairs of Malaya, particularly when the subscription carries with it certain benefits which can fairly be considered as giving full value for money.

Life membership can be obtained for the modest subscription of $20.

MALAYAN CHRISTMAS HAMPERS.

Although it is probably somewhat early to discuss Christmas, this preliminary notice is given that the Malayan Agri-Horticultural Association proposes again to organise a scheme for the supply of Christmas Hampers of Malayan produce.

While plans are not yet complete it may be said that it is hoped this year to have alternative hampers available to suit varying purses and recipients.

Fuller particulars will be published in the October issue of this Magazine and in the meantime, enquiries should be addressed to the Secretary, P. O. Box 323, Kuala Lumpur.

Horticulture.

GARDEN PLANNING IN MALAYA (*Continued*)

BY

F. FLIPPANCE, F.R.H.S.

Assistant Curator, Botanic Gardens, Penang.

The Medium Garden.

This type of garden is from one to two acres in extent. It is one of the most interesting of modern types as it is sufficiently large to afford space for specialising.

The design now presented shows the type of primary layout, i.e., disposition of buildings, roads, entrances, etc., commonly met with in Malaya in gardens of this size. Owing to its primary layout, it is not possible to specialise to a great extent, but provision has been made for the incorporation of two small gardens in the general design. Apart from this, the design follows the general principles of layout compatible with the primary layout.

Figure V.

This design is adopted to an area of slightly less than 1½ acres. The actual measurements are: frontage 210 feet, lateral boundaries 300 feet. The house is in proportion to the garden and has a north aspect. The garage and garage road have been placed on the west or "hot" side of the house, thus ensuring quietness on the east or "cool" side. The servants' quarters, garage, etc., have been cut off from the garden by hedges, inside which there is ample room for a plant-house and for a back-yard. The house will be of the two-storey type and steps from the ground floor to the garden are shown. These latter give access to the small areas reserved for special gardens. The symmetrical positioning of the house and drive indicates that a symmetrical layout should be adopted and this type of layout has been emphasized in the accompanying design though without too much formality.

To describe the plan it will be necessary to deal with it in sections. These are as follows:—

Sections.

BOUNDARIES—These are the hedges completely enclosing the area. An additional hedge cuts off the domestic offices from the garden.

CENTRAL SECTION—This is the area bounded by the front hedge between the entrance and by the drive.

EASTERN SECTION—Consists of the area bounded by the part of front hedge, east lateral hedge, part of rear boundary hedge, east part of inner hedge, east wall of house and by the east drive.

WESTERN SECTION—Comprises the area bounded by part of front hedge, west lateral hedge, west part of inner hedge, west wall of house and by the west drive.

Explanation of Layout.

BOUNDARIES—These hedges should form an unbroken line around the area

save at the entrances. This will ensure privacy and for this reason alone they should be kept in good condition. The inner hedges should be well maintained as they completely shut out the domestic offices and ensure privacy inside the boundaries.

CENTRAL SECTION—This section comprises the large central portion of the garden. It forms the central feature of the design and should consist of a well kept lawn. There is ample room for a full-size tennis court i.e. 60 feet x 120 feet which is correctly oriented. Owing to its prominence, this area must be tastefully laid out. Being of a symmetrical shape, it is necessary that the planting should be of a symmetrical nature. It will be seen that the planting is confined to two parts—near to the front boundary and near to the house. This leaves a large expanse of lawn which tends to give an idea of spaciousness. The design is simple and easy to carry out, but the marking out must be done with the measuring tape as it is very important that the border and beds should be correctly positioned. Approximate positioning will spoil the whole design.

The layout for this section is as follows:—

BORDER 1—This border is designed to serve two purposes. Firstly, it provides a mass of planting at the extreme end of the lawn which, when viewed from the house, gives colour and by its undulating outline, a slightly informal appearance. Secondly, the produced ends of the border serve to conceal almost all of the central area from the road. This is a useful point to observe, as it gives privacy when the tennis court is in use. It will be seen that the border is made up of two parts. The two extremities and the back central portion are meant to be shrub borders, while the remainder should serve to produce a bright display of colour.

BED 2—This bed is curved to conform with the line of Border 1. Together with the planting behind it (Shrubs 3, 4, and 5), it gives somewhat the effect obtained by the central portion of Border 1.

SHRUBS 3 AND 5—These are scandent shrubs to soften the corners of the house.

SHRUB 4—This should be a tall scandent shrub.

SHRUBS 6 AND 7—These are bush shrubs to emphasize the curved bed and relieve flatness.

BEDS 8, 9, 10 AND 11—These are flower beds to provide colour. They follow the line of, and thus emphasize, the curves of the drive.

SUPPORTS 12 AND 13—These are plant supports for creepers and are to counteract any suggestion of flatness, which may be created by the flower beds.

EASTERN SECTION—This section serves to join up on the eastern side, the planting on the central section. It is possible in this section to set aside an area 90 feet x 60 feet for the development of a special garden. Correct planting, particularly that near the house, is of the greatest

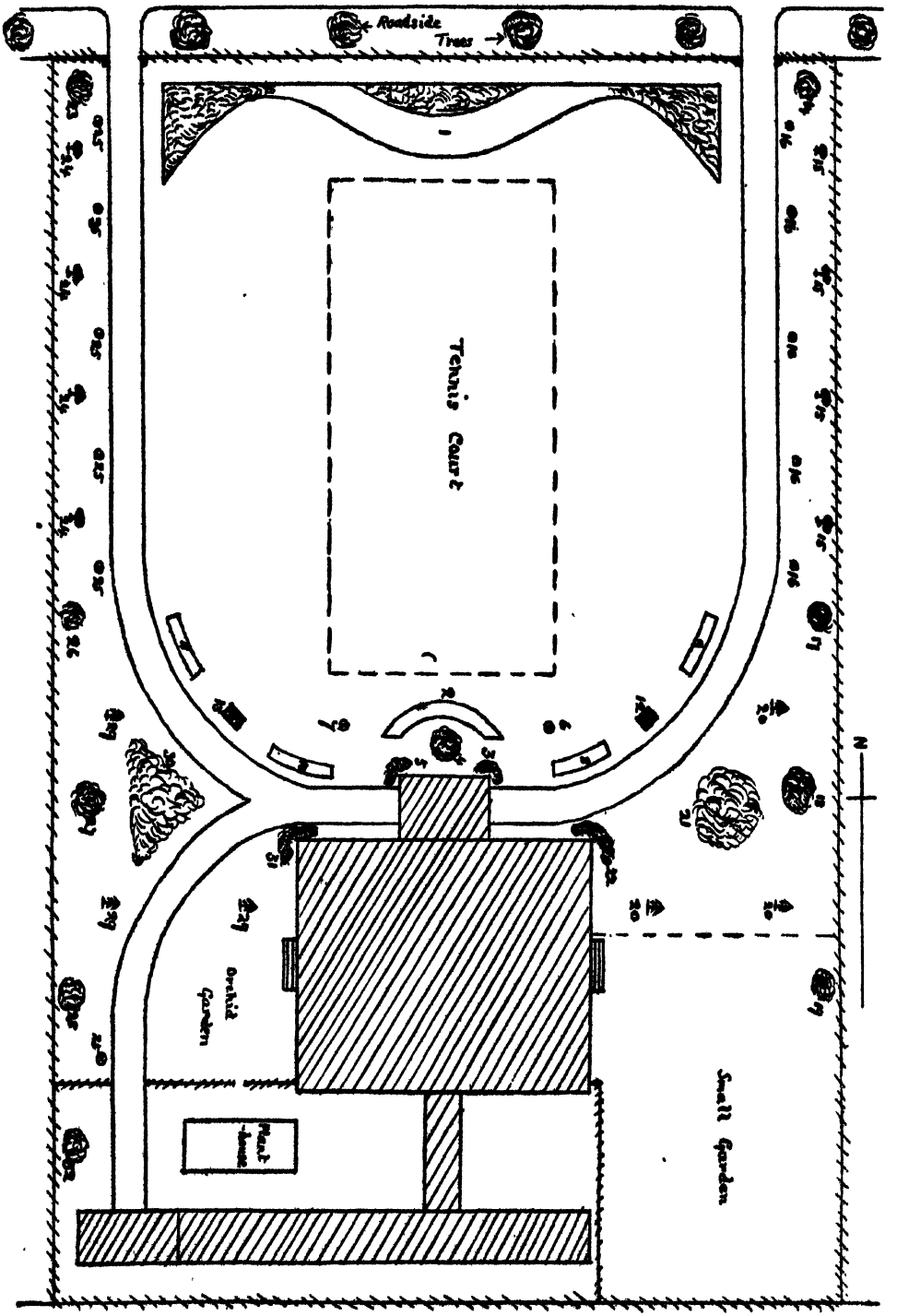


FIGURE V

importance if the effect aimed at is to be obtained.

The layout is as follows:—

TREE 14—This is a tree to give support and height to the extremities of Border 1.

TREES 15—This is a row of small flowering trees to give colour along the boundary.

SHRUBS 16—This is a row of flowering shrubs of a bushy habit.

TREE 17—Large tree for screening purposes and to give height.

TREE 18— ditto

TREE 19— ditto

TREES 20—Three conifers of bushy habit to provide a screen of foliage.

TREE 21—A flowering tree of spreading habit to assist in providing a screen of foliage.

SHRUB 22—A scandent shrub to soften the corner of the house.

SMALL GARDEN—This garden should be developed in accordance with the desires and tastes of the householder. It can be laid out in many ways e.g. as a special Shrub-garden, as a special Canna-garden, as an Annuals-garden, as a small Paved-garden and so on. It is not proposed to give a layout for this garden, as such gardens will be dealt with in designs for "Large Gardens."

WESTERN SECTION—This serves a similar purpose to that of the eastern section and its planting is of equal importance. In this section provision has been made for a small orchid garden.

The planting is as follows:—

TREE 23—Balances Tree 14.

TREES 24—Row of small flowering trees to balance Trees 15.

SHRUBS 25—Row of bushy shrubs to balance Shrubs 16.

TREE 26—Large tree for screening, shade and height purposes.

TREE 27— ditto

TREE 28— ditto

TREES 29—Conifers to balance Trees 20.

TREE OR SHRUB 30—Small spreading tree or large mass of scandent shrub to balance Tree 21.

SHRUB 31—Scandent shrub to soften corner of house.

TREE 32—Large tree for shade purposes.

ORCHID GARDEN—This small area is for sun orchids such as Vandas, etc., subjects which should have a sunny place to themselves as they are not attractive save from a flower point of view. In the area set apart for them they will be screened from general observation and will in no way affect the general layout. Details for layout of this section are not given as the layout for an orchid garden will form the subject of a later article.

It may here be mentioned that a small opening in the hedge beside the orchid garden allows of easy access to the plant-house for the purpose of exchange of plants between house and plant-house.

Plants suggested for Lay-out.

As in previous articles names of species are given from which a selection can be made.

BOUNDARIES—The following species are suggested:—

Hibiscus—rosa-sinensis or its varieties.

Bamboo—usually produces the best hedges for a garden of this size.

Bougainvillaea glabra—makes an excellent hedge but would require supports to produce and maintain a six feet hedge.

The above species are the most reliable ones for the length of hedge required to surround a garden of this area.

CENTRAL SECTION.

BORDER 1—The border has for a background the six feet hedge and the roadside trees. It consists of (i) a shrub section and (ii) a flower section.

Plants suggested are as follows:—

(i) Shrub section—*Hibiscus spp., Ixora spp., Brunfelsia spp., Thunbergia erecta, Cassia spp.,* (shrub types) *Kopsia fruticosa, Bauhinia spp., Nerium oleander, Petrea rugosa,* etc. Should coloured foliage plants be desired—*Acalypha spp.* and *Eranthemum spp.* should be included.

(ii) Flower section—This section can be treated in "herbaceous border" fashion or as a Canna border with an occasional change to an annual such as Amarantus.

Either treatment should produce a good display of colour. Care must be taken to keep the taller growing shrubs to the back of the shrub sections. If properly carried out, considerable variation in height can be obtained in this border. It must be tastefully carried out as it is the most prominent feature at the road end of the garden.

BEDS 2, 8, 9, 10 AND 11—These beds should be kept bright by the use of Annuals, such as:—Cleome, Balsam, Michaelmas Daisies, Verbena, Zinnia, Celosia, Amarantus, Helianthus, Coreopsis, etc.

SHRUBS 3 AND 5—*Congea tomentosa, Bignonia magnifica, Bougainvillaea spp., Petrea volubilis,* etc.

SHRUB 4—*Bougainvillaea spectabilis*—pink variety, trained into a tall standard would be very suitable for this. Another suitable species would be *Plumeria alba* (the large white Frangipanni).

SHRUBS 6 AND 7—*Petrea rugosa, Ixora spp., Hibiscus spp., Nerium oleander* varities, *Poinsettia*—if well grown, but not if the pink Bougainvillaea is used for Shrub 4. *Juniperus chinensis*—two good plants.

SUPPORTS 12 AND 13—Honolulu, Dipladenia, Clematis, *Porana volubilis, Jacquemontia violacea,* etc.

EASTERN SECTION.

TREE 14—*Mesua ferrea, Cassia grandis.*

TREE 15—*Cassia javanica, Cassia renigera, Cassia fistula* (Indian

Laburnum) *Cassia multijuga, Jacaranda,* etc.

SHRUBS 16—*Randia macrantha, Ixora spp.*

TREE 17—*Mesua ferrea.*

TREE 18—*Pterocarpus indicus* (Angsana).

TREE 19—*Erythrina indica* or its variety *Parcelli* (variegated form).

TREE 20—*Dacrydium elatum* (Ru Bukit) *Cupressus spp.* (bushy forms).

TREE 21—*Brownea spp.*

SHRUB 22—*Congea tomentosa, Bignonia magnifica, Petrea volubilis,* etc.

WESTERN SECTION.

TREE 23—*Mesua ferrea, Cassia grandis.*

TREE 24—*Cassia spp.*, Jacaranda, etc.

SHRUBS 25—*Randia macrantha, Ixora spp.*

TREE 26—*Mesua ferrea.*

TREE 27—*Pterocarpus indicus* (Angsana).

TREE 28—*Erythrina indica.*

TREES 29—*Dacrydium elatum, Cupressus spp.*

TREE OR SHRUB 30—Trees—*Brownea spp., Amherstia nobilis, Saraca spp.* Shrubs—*Bougainvillaea glabra* and *Congea tomentosa* mixed, form a very attractive mass.

SHRUBS 31—Congea, Bignonia, Petrea, etc.

TREE 32—Angsana or Rain Tree.

Special Features of Design.

Seclusion, spaciousness and simplicity have all received due attention. Domestic offices are completely blocked out.

A plant-house has been provided at a point where it will not become an eyesore. It can be worked easily and is convenient for inter-change of plants between house and plant-house.

Large trees for shade and screening purposes are provided.

Two small gardens are provided for, inside the general design. These offer facilities for specialising and add interest to the garden generally.

The planting in the side sections (east and west) beside the drive serves to join up the planting at the extremities of the lawn area (central section).

The massed planting at the house end of the eastern and western sections will eventually provide a screen of greenery in which the house will appear to nestle. Also, it will provide perfect screening for the two small gardens.

The sharp corners of the house have been softened by the use of scandent shrubs. These produce an intimate association between the house and garden. This is a point which should be aimed at in all garden designs.

The design provides for the use of a large number of ornamental and interesting species. When the first outlay in plants and planting has been borne, only the flower beds will need recurrent planting.

THE FOOD REQUIREMENTS OF PLANTS*

BY

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The old question: " Which came first in the history of the world, plant or animal life?" is easily answered if one understands that the primary distinction between animals and plants is based upon a difference in the method of nutrition. Plants *build up* their food from simple chemical elements: animals, directly or indirectly, obtain their food ready-made. Animals are like the fire which has constantly to be supplied with fuel; plants are the fuel itself. Obviously, therefore, plant life came into being before animal life, and we do not need the evidence of geological sequence to bear this out.

The starting off point in any discussion of the nutrient requirements of plants is a knowledge of this vitally important power possessed by them of being able to synthesise food from the elements.

Only ten elements are essential to all plant growth, though certain other ' minor elements ' are required in specific cases. These are: carbon, oxygen, hydrogen, nitrogen, phosphorous, potash, calcium, magnesium, sulphur and iron. The first three mentioned, carbon, oxygen and hydrogen, are obtained by the plant from the air and from water and together form about 95% of the plant body. The remaining seven elements are absorbed from the soil in dilute water solution by plant roots.

Strictly speaking, the various elements as assimilated by the plant, are not " food," but " food-making materials." They only become food when synthesised or built up into complex substances such as sugars, which are transported by the conducting strands within the plant for the nutrition of growing cells. If not immediately required, the soluble sugars are passed to special parts of the plant where they are converted into still more complex substances, such as starch, proteins, fats and celluloses and stored away as reserve material. Plant food in the proper sense is therefore much the same as animal food: the difference is that the plants manufacture their own food from simple elements, whereas animals exist by a process of robbery. Plants build; animals destroy.

The amount of activity that goes on within plant tissues in order to synthesise elements into the food, upon which both they and we subsist, is truly amazing, and it is well that we should have some conception of the processes at work.

Natural Resources.

A grain of maize contains, among other things, 45% carbon, 46% oxygen and 6.4% of hydrogen, together forming 97.4% of the fruit. The

* Lecture to Selangor Gardening Society, 22nd March 1934.

entire amount of carbon was obtained by the plant from the carbon dioxide of the air being breathed in, so to speak, by means of millions of mouth-like pores scattered over the leaf surfaces. About 100,000 of these pores, or "stomata," are present per square inch of leaf surface, so that there are literally more hungry mouths to be fed in a few stalks of maize than there are people in the whole world.

By means of the green colouring matter of the leaves and under the influence of sunlight, the carbon is thereafter combined with oxygen and hydrogen to form simple sugars. The entire process is known as "photo-synthesis," which means a building up by aid of light.

There is only a very small amount of carbon dioxide in the air, which consists almost entirely of nitrogen and oxygen. The plant, therefore, has to do a lot of work to secure its supply. Actually, 10,000 lbs. of air contain only 4 lbs. of carbon dioxide or 1 lb. of pure carbon. Now a good, 100 bushel per acre, crop of maize grain weighs about 5,600 lbs., of which something less than half, or 2,500 lbs., is of pure carbon. Simple calculation shows that our one-acre crop of maize must have passed through its leaves in the growing season, the amazing amount of 25,000,000 lbs. or 11,000 tons of air in order to form the grain alone! Estimating for the rest of the plant body, more than 22,000 tons of air pass through an ordinary one-acre crop of maize in the growing season. This is equivalent to about 4 or 5 tons of air per one square yard of standing crop.

There is, in fact, so little carbon in the air that the total air above one acre to the height of the atmosphere, contains only enough to supply two big crops of maize (grain and straw). Yet the supply is in no danger of exhaustion owing to constant replacement by the decay of vegetable matter and the expiration of carbon dioxide by animals.

The plant derives its supply of hydrogen from water taken in by the roots and transpired through the stomata or breathing pores of the leaves. As all the other elements are absorbed by plant roots in dilute water solution, it is interesting to consider the enormous amount of work that our maize crop has to do in order to provide itself with the comparatively few pounds of the soil elements so essential to its proper nutrition.

For every 1 lb. of dry substance in the maize plant, about 30 gallons of water must be taken in by the roots and transpired through the breathing pores. This means that a 130 acre crop of maize transpires enough water in one year completely to fill the Ampang reservoir (40 million gallons). Or, to put it in a different way, 2¾ square yards of standing maize transpires as much water in the growing season as a man will consume in his drink and food in a whole year.

The carbon, hydrogen and oxygen acquired from air and from water in these ways at such a prodigious expenditure of energy, are combined within the plant tissues to form the sugars, starches, celluloses and fats, required as food or as reserve material. At first it seems surprising that,

since 95% of the plant body is composed of these three substances, the attention of the practical agriculturalist should be focussed on elements contributed by the soil, which furnish only 5% of the crop. Yet the reason for this is clear.

All the elements mentioned are essential for plant growth. If one is totally lacking, the soil will be infertile and barren. Now, albeit with much labour, the plant can always obtain a sufficiency of carbon and oxygen, and of hydrogen provided water is available, it often happens that a soil is deficient in one of the other elements and, as the size of a crop will be determined by the amount of this available—a point which will be discussed later—the farmer can remedy matters by application of this to the soil in a form suitable for plant uptake.

With the exception of nitrogen, which is derived from the decay of vegetable matter, the six other nutrient elements originate from rocks, being slowly rendered available to plants by rock decomposition consequent upon the natural process of watering. The release of these elements in a soluble form is so slow that even if the rocks contain comparatively large amounts, there may be insufficient present in the soil in a form available to crops. Soil resources are therefore limited. Each crop that we harvest and remove means a large loss of once available nutrients, so that by continuous cropping, the soil rapidly becomes exhausted to the point it cannot bear a satisfactory crop unless food-making materials are supplied artificially.

The soil, however, does not contain equal amounts of each element, and plants use more of one element than they do of another. Some nutrients, therefore, are constantly present in the soil in superabundance, whereas others are commonly deficient. The earth's crust, for example, contains more than 40 times as much iron as phosphorous, whereas a grain of maize contains nearly 40 times as much phosphorous as iron. This means that the soil supply of phosphorous would be depleted as much by the removal of 100 crops of maize as would the supply of iron by 160,000 crops.

Artificial Fertilisers.

Hence it is that, of the seven elements supplied by the soil, only three are commonly deficient. These three are nitrogen, phosphorous and potash and it is upon the application of these to the soil in forms suitable for plant uptake, with the addition of lime where necessary, that the whole theory of manuring depends.

Nitrogen is the element chiefly responsible for actual growth of the plant. It is essentially a foliage former. If applied too abundantly, it tends to produce rank growth and to delay maturity.

Phosphoric acid essentially promotes root formation and hastens maturity. It is present in the nucleus of every living cell; it produces abundance rather than bulk.

Potash is necessary for starch formation. It greatly improves the vigour of plants, the quality of produce, and strengthens the plant against

disease.

Calcium or lime is not applied to the soil as a food material—there usually being ample present for that purpose—but for its indirect effects. It neutralises over-acid soils, greatly improves the tilth of heavy clays, renders more insoluble nutrient elements available to plants and improves the content of the soil in beneficial micro-organisms.

That crop yields can be markedly increased by the use of manures has long been known to practical farmers all over the world. Centuries ago, Cato said: "Wherein does a good system of agriculture consist? In the first place by good cultivation; in the second place by good cultivation; and in the third place by manuring." This is as true to-day as it was then, but our knowledge both of the theory and practice of manuring has grown very considerably. Although aware of the beneficial effects in soil texture and soil bacterial content produced by the application of certain natural substances, such as farmyard manure, we now know that these furnish only a very small amount of actual plant nutrients. The best agricultural practice of to-day consists in applying to the soil as much natural manure as is available on the farm and of supplementing this by artificial fertilizers which contain large amounts of the nutrient elements and furnish these at a much lower cost per plant food unit.

We can now conveniently and inexpensively supply our crops with single nutrient elements or element combinations in any desired proportion. Most of these products are pleasant to handle and distribute, have no smell and are perfectly hygienic. Thus, the main growth and foliage-forming element, nitrogen, can be supplied best by sulphate of ammonia, which contains 20.6% of that nutrient, or about forty times as much as is contained in farmyard manure.

Similarly phosphoric acid and potash can be supplied by rock or superphosphate and by sulphate or muriate of potash respectively. The most up-to-date practice consists in applying element combinations in the form of synthetic salts, such as "Nicifos," which contains both nitrogen and phosphoric acid in quickly available forms, or "Enpekay," a range of "complete" fertilizers containing all three elements in desirable proportions and in a highly concentrated form.

Conditions for Manuring.

Before considering the practical application of nutrient elements to the crop in the form of fertilizers, it is necessary to have a clear idea of *when* to manure.

If a crop is backward in growth and it is suspected that the cause is lack of plant food, the first thing to do is to study the other growth factors and to ensure that these are satisfactory before proceeding further.

All plants require an adequate supply of food, water and light, a suitable temperature, root room and an absence of injurious substances from the soil. A condition of insufficiency of any one of these will pro-

portionately limit the amount of growth that the plant can make and, if absent, the soil will be barren. Should there be a lack of water for example, then this becomes the " limiting factor " to plant growth and it would manifestly be absurd to waste money on fertiliser treatment. One manures only when one is certain that all other growth factors are met and that malnutrition is indeed the sole cause of low yields. Growth of the plant may be compared to a chain, the breaking point of which depends upon the strength of its *weakest* link. No matter how strong all other links may be, the chain will always break at the weakest one and the strength of the chain will increase in proportion as the weak link is thickened. If two links are weak, corresponding, say, to deficient water supply and a lack of nutrients, matters will not be improved until *both* links are strengthened. If it is impossible to remedy both, nothing can be gained by repairing one.

Other conditions being satisfactory, the question of manuring can be tackled. Here again the same law applies: *the amount of growth that a plant will make is determined, within certain limits, by the nutrient element present in least amount.* Suppose there is enough phosphoric acid present in the soil to grow a 40 bushel crop and enough nitrogen to grow a 50 bushel one, then the size of the crop will be limited to 40 bushels and it would be useless to supply more nitrogen in the hope of increasing the yield.

Soil Type and Crop.

The amount of each element to apply for increased crop production will also vary according to the soil type and crop under cultivation.

Different soil types contain different amounts of nutrient elements. Thus, sandy soils have practically no available plant foods and respond decidedly to treatment with the three elements. Clays usually contain sufficient potash. Peaty soils have abundant nitrogen but are often very acid and require liming. Malayan soils in general are very deficient in nitrogen and phosphoric acid, but usually contain sufficient potash.

A fertiliser which adequately meets the needs of a particular crop may fail to suit a different crop cultivated on the same soil, since each crop has its own specific nutrient requirements. Maize, for example, will remove from the soil twice as much nitrogen as it will potash, whereas sugarbeet will only take up two-thirds of the nitrogen that it will potash.

The age of a plant too, has considerable influence on the kind and amount of manure to apply. Mature rubber, for example, is only concerned with the maintenance of its comparatively sparce foliage, so that nitrogen alone will bring as good a response as nitrogen, phosphoric acid and potash. Young rubber, on the other hand, is building up root trunk and foliage and has a decided requirement for phosphoric acid and potash in addition to nitrogen. By treatment with the three elements it is easy to bring young rubber into tapping one year earlier than untreated and with a

higher latex yield.

By studying crop and soil requirements in this way it is often possible to economise by cutting out one or two of the three main elements. When a specific fertiliser treatment has been decided upon and a marked response obtained thereby, it does not follow that the dressing should be increased until it produces the maximum possible yield. There is a limit to the amount of growth that a plant can make and as this is approached a slowing down occurs. If, for example, the application of a fertiliser at the rate of 1 cwt. per acre increases the yield by 50% and this just pays, it obviously would be a loss to double the dressing and only get an 80% increase.

From this brief account of the food supply of plants it will be clear that if our aim is to correct a nutrient deficiency by the application of fertilizers to the soil, many important factors must be taken into account. It is only too easy to throw away money by treating land with fertilizers when malnutrition may not be the limiting factor, or by applying three elements when only one may be lacking; but with a little knowledge and some commonsense the judicious use of fertilisers can bring the land into optimum fertility.

Although it is true that it does not always pay to manure for increased crop production when prevailing prices are low, it should be our aim at least to replace as much nutrient as we take away in the harvested crop and so maintain the fertility of our rightful heritage, the soil.

Poultry.

POULTRY KEEPING.

The following notes, which were prepared by the Department of Agriculture, form part of the lantern slide lecture on poultry which is included in the instructional programme of the Rural Lecture Caravan, owned jointly by the Department of Agriculture, the Co-operative Societies Department and the Rubber Research Institute of Malaya.

Feeding.

The importance of correct feeding cannot be over emphasised. In poultry keeping, as in everything else, one only obtains results in proportion to the amount of care, labour and material invested.

Birds which are kept on a free range, as in Malayan kampongs, require smaller quantities of artificial feeding stuffs than birds which are confined to pens. Grubs, insects and worms will to a great extent fulfil the birds' meat requirements and the natural green-food available to them is not likely to need augmenting.

Birds kept on a free range might, with advantage, be supplied with a wet mash in the morning. Padi must, of course, be given to them in the evening. Wet mash is fed to poultry in the morning in a limited quantity which should be consumed by the birds within half an hour.

Among the ordinary constituents of kitchen refuse which may with advantage be given to poultry in the form of a wet mash are fish heads, tails and bones, scraps of meat and meat bones, parings of vegetables, cabbage, lettuce and spinach leaves and the bud or 'umbat' of the banana stalk removed after fruiting. The fish and meat materials should be boiled if they are hard and difficult to mix, they should then be minced and broken up by pounding and mixed with from 10 to 15 times their weight of padi bran, cooked rice or stale bread crumbs; the mash should be fed to the birds from a trough. If salt fish is used it should be soaked in hot water just before it is required in order to remove the salt. All vegetable remnants should be placed in cold water until required and only chopped up immediately before feeding. In the case of fibrous vegetable material, care should be taken to cut it into small pieces to prevent the birds from becoming crop-bound by portions of long hard fibre. It is most important not to give stale or decomposing vegetable or animal matter to the birds as such food causes stomach trouble.

The fat removed from meat remnants should be melted and poured over bran or rice refuse and carefully mixed. This addition of fat is only suitable for birds which are being fattened for the table. An excess of fat reduces the egg production of laying hens.

Mashes should always be fed to the birds in troughs and never on

the ground. The trough in which dry mash is provided throughout the day must be protected from the rain.

Padi, which must be fresh and free from moulds should be supplied to the birds in the evening at the rate of about 1½ to 2 tahils per bird, part in a trough and part scattered on the ground. Young birds should be fed with broken rice as whole rice is too large and they cannot remove the husk of padi.

Green gram, or kachang hijau, is greatly liked by poultry and can be mixed in the proportion of 1 part to 5 parts of padi. The grain feed must be supplied in definite known quantities as this diet can be used to regulate the condition of the birds; thus if they show a tendency to become too fat, the evening grain ration may be increased, when the birds will be found to require less mash during the following day. Similarly if the birds are required to put on flesh the grain supply should be reduced and the mash feed increased proportionately.

The necessity of providing poultry with an adequate supply of lime for shell production, and of grit to assist digestion, is obvious and has long been recognised. It has been proved that mineral deficiency is the cause of certain ailments in poultry.

Grit is necessary to poultry and replaces the action of teeth in reducing grain and other food in the crop to a sufficiently fine state so that the nourishment can be absorbed by the digestive organs. The grit should be hard—the harder the better—and have sharp angles. A stone which readily breaks into thin flat flakes should be avoided as it is liable to cause internal wounding. Sand, which can be washed on ordinary wire ' mosquito ' netting so that the small particles and earth are extracted, is readily obtainable and will be found satisfactory.

Poultry obtain a certain amount of lime from their food-stuffs, but in many parts of Malaya, where the soil may be deficient in lime, it is probable that the birds will not obtain an adequate supply, resulting in thin or soft-shell eggs.

Broken oyster and other shell or limestone are the more usual alternative sources of lime for feeding to poultry. The choice of the particular source of lime will, therefore, depend upon that which is most readily procurable.

It should not be forgotten that certain waste products are suitable for use in this connection e.g. unburnt stone from lime kilns, old mortar from buildings. On no account should unslaked burnt lime be given to poultry.

A suitable mineral mixture is one of equal parts of lime, salt and finely crushed bone. Salt must always be used with caution as 3 per cent. of salt is generally fatal to poultry.

Freshly powdered or broken charcoal is useful for poultry as it appears to have a cleansing action on the stomach. It is usually supplied in a separate container from which the birds can help themselves at all times.

Diseases.

Dirt, damp, draughts, overcrowding and poor feeding are the principal factors which predispose birds to the attack of diseases.

There are several specific diseases which are common causes of death amongst poultry, of which those which attack the intestines of the birds are the most serious as if left unchecked they generally spread rapidly, as does cholera among human beings and may destroy an entire flock of both young and old birds.

The general symptoms of almost all intestinal diseases are acute diarrhoea in which the droppings are of liquid nature, loss of appetite, a tendency to stand motionless with the feathers ruffled and the head, wings and tail drooping.

These diseases of the intestines are caused by germs which attack the bird when its general health is low. The germs are passed out of the bird in its droppings in great numbers and remain in the soil or in water where they are liable to be picked up by other birds when pecking for food or when drinking.

It is of the utmost importance that a sick bird should be removed from the flock at the first signs of intestinal disease if it is hoped to check its spread.

As there is no method of curing birds suffering from intestinal diseases any bird suspected of being infected should be immediately killed and the carcase destroyed by burning or by burying deeply in a place to which the poultry do not have access.

It should be emphasised that the immediate removal and destruction of a subject showing signs of diseases is of even greater urgency among very young birds because, as a general rule, one sick member will infect a brood of chicks in a very short space of time with fatal results.

Intestinal Worms.

Parasitic worms are commonly present in the intestines of birds in this country. They are passed out of the body in the droppings, and may contaminate the food and water of other birds which thus become infected. So easily can this contamination occur, especially under kampong conditions, that the majority, if not all of the birds in a flock are usually infected. In extreme cases, the worms may cause death, but, as a general rule, they have a weakening effect which more or less seriously interferes with the general health of the birds, lowers their resistance to other diseases, and reduces egg-production. Although medicines are obtainable which can kill all worms and worm eggs inside the body, this method of treatment cannot be advocated in the kampong for the simple reason that the birds would almost certainly become reinfected soon after treatment. The best method of control is to give the birds some cheap and easily procurable medicine, *at regular intervals*, which will expel the majority of the worms in the course of a few hours, so preventing the worms which

remain in the body from becoming so numerous as to cause harm. Powdered arecanut is the best medicine for this purpose, and can easily be administered by mixing I teaspoonful of the powder per 12 birds in their wet mash once every 2 or 3 weeks. The droppings should be carefully collected and burnt during the next 24 hours, in order to destroy the worms which have been expelled. The success of this method depends entirely on the regularity with which the arecanut is given. There is no necessity to prepare fresh arecanut powder each time: the best plan is to prepare a quantity of the powder when freshly ripe nuts are available, and to store this powder in an air-tight tin or bottle.

The other types of common poultry diseases are those of the breathing organs.

Colds.

As has already been said, damp and draughts cause birds to catch colds in the same way as human beings and these frequently develop into pneumonia which causes death.

During the wet seasons it is advisable to protect poultry from the rain and wind as much as possible in the daytime as birds which go to roost at night in a damp condition are very likely to develop colds.

Fowl Pox.

This is a further serious disease of poultry which occurs in Malaya in which the skin of the mouth, nose and around the eyes becomes covered by a tough, grey or yellowish coloured membrane (scab) which exudes pus. The comb and wattles are frequently affected and develop warty-looking nodules.

This disease invariably ends by causing death. It is highly infectious, therefore all affected birds should be destroyed at the first signs of the onset of the disease.

Scaly Leg.

This is a fairly common disease of poultry in this country, and is caused by a tiny mite which burrows and feeds beneath the scales of the leg, thus causing irritation and weakness. That part of the leg which is covered with scales eventually becomes much swollen. The mite spreads easily from bird to bird, and is difficult to kill. If a bird is badly attacked, it should be destroyed. If the attack is but slight, the leg may be dipped for a minute or two each day in kerosene, taking care that the oil does not touch the tender skin or feathers of the bird. After dipping, the excess oil is wiped off with a rag. Even with this treatment, the cure is usually slow, and it is probably better to kill all infected birds unless they are particularly valuable. If the infection is but slight, there is no objection whatever to cooking and eating the bird.

Depluming Mite.

This is another fairly common pest of kampong birds. The mite burrows under the skin, usually on the back near the neck, and causes

the feathers to fall out. It spreads easily, and there is no really satisfactory cure under kampong conditions. Infected birds should therefore be destroyed.

As has been stated, no reliance can be placed on the use of medicinal cures for poultry diseases; it remains only for the poultry keeper to endeavour to maintain the health of his flock through careful feeding, housing and sanitation, and to maintain rigidly a constant observation of all birds so that individuals showing signs of illness may be removed from the flock and destroyed.

General prophylactic measures for Intestinal Diseases.

(1) No eggs should be used for hatching except those which come from birds of proved good health.

(2) All eggs should be set under healthy birds and on clean, freshly dried grass or similar material.

(3) The materials used in the nest box should be renewed whenever they become soiled.

(4) Young chicks should be kept on ground on which no adult bird, other than the parent hen, has been previously housed.

(5) Drinking water and food must be kept in receptacles so placed that birds cannot enter and foul them.

(6) All houses should be cleaned daily and disinfected when necessary with a solution of disinfectant, such as ' Izal,' ½ oz. to a gallon of water.

(7) The flock must be carefully observed daily for any signs of ill health.

(8) Immediate isolation of all birds suspected of being infected with an intestinal disease is of the greatest importance.

(9) Birds which are observed to show symptoms of any of the diseases already described should be destroyed and their carcasses be burnt or buried deeply.

(10) Ground to which diseased birds have had access is certain to be infected with the causal organisms and healthy birds should not be allowed entry to such areas. Infected ground should be allowed to lie fallow for several months and if possible be treated with quicklime.

(11) It must be remembered that errors in diet predispose the intestinal tract of poultry to the attack of disease germs, therefore correct diet does much towards reducing the occurrance of disease.

In conclusion it may be said that while suitable diet and good sanitation cannot be expected completely to protect poultry from disease, which may be introduced by various means, much can be done towards minimising the effects of disease.

Constant observation of the flock and immediate removal and destruction of birds which are suspected to be suffering from any infectious disease will help to prevent the loss of an entire flock, a happening which is a not infrequent experience of the poultry keeper in Malaya.

Reviews.

The Ferns of Mount Kinabalu,

Carl Christensen and R. E. Holttum.

The Garden's Bulletin, Straits Settlements, Vol. VII, Part 3 (1st. June, 1934). 12 plates and 3 text figures and index. Price $3/-. Botanic Gardens, Singapore.

The recent issue of the Gardens' Bulletin, Straits Settlements, contains a descriptive account of the ferns collected on Mount Kinabalu, British North Borneo, and its surroundings up to the end of 1931. Mr. Holttum, Director of Gardens, S.S. spent three weeks in November, 1931, collecting specimens on this mountain and these together with previous material total 417 species, which are now included in the paper under review. Thirty new species of ferns are described and full citation given of those already known to science. A complete set of Mr. Holttum's specimens was placed in the hands of Dr. Carl Christensen, who had already undertaken the examination of a large number of type specimens of Bornean ferns. Dr. Christensen is responsible for the greater part of the descriptions of the species now enumerated.

The major part of the paper is of particular interest to the systematist and, since as Dr. Christensen states, the ferns of Borneo are closely related to those of Malaya and Sumatra, its value to knowledge of local *Filicales* is considerable.

Mr. Holttum contributes field notes and references to the topography of the mountain. It is thus possible to envisage the various types of fern flora from the foothills of Mount Kinabalu to Pakka (10,200 feet) at the edge of the continous forest.

The present contribution from the Botanic Gardens, Singapore, is welcome and it is hoped may lead, in due time, to an authoritative account of the *Pteridophyta* of Malaya; a branch of botanical science to which the present Director has already made so many valuable contributions. Such an account, as is generally known, is lacking since Ridley in his *Flora of the Malay Peninsula* (1922) dealt only with the *Spermaphyta*.

J. N. M.

Gardening for Amateurs in Malaya.

Edited by Mrs. E. D. Butler.

Published by the Young Women's Christian Association. $1/-.

This little book is a welcome addition to the literature of horticulture in Malaya and Mrs. E. D. Butler, who edits it, is well known as an enthusiastic amateur gardener.

The numerous articles, which include certain that have already appeared in local publications, are particularly informative and will be of considerable help to all local gardeners whether amateur or professional. They cover most of the problems and difficulties with which one is likely to meet, from the propagation of plants from seed and vegetative propagation to insect pests and plant diseases. There is an extremely interesting article on soil by Mr. C. L. Newman and another on turf maintenance by Mr. E. J. McNaughton. Mr. A. R. Westrop contributes an article on the use of fertilisers, that essential aid to gardeners, if satisfactory results are to be obtained. Other articles deal with ferns, shrubs and climbers, ornamental and shade trees, orchids, hedges, vegetables and other subjects.

The entire profits on the sale of this little book go towards the work of the Young Women's Christian Association in Malaya, so purchasers of it are helping a worthy object in addition to increasing their knowledge of gardening lore.

Mention must also be made of an attractive cover design by Mrs. E. P. Hodgkin.

H. L. B.

The Malayan Agri-Horticultural Association.

ELEVENTH MALAYAN EXHIBITION.

The annual Malayan Exhibition was held this year during His Majesty The King's Birthday Holidays, the 2nd, 3rd and 4th June at Kuala Lumpur.

Unfortunately the weather was somewhat uncertain and heavy rain fell on two days affecting the attendance to a certain extent. Even so, the total number of visitors was 22,588 as compared with 20,093 in 1933.

The lay-out had still further been altered to cope with the increasing demand for space and once again called forth favourable comment from visitors.

The Trade Section required nearly the whole of the main permanent building and a large attap building measuring 100 feet by 80 feet was erected to house the Village Industries Section which also proved to be considerably larger than in former years.

The Opening Ceremony.

The Hon'ble Mr. M. B. Shelley, C.M.G., Chief Secretary to Government, in the presence of a distinguished gathering which included their Highnesses the Rulers of Selangor and Negri Sembilan, opened the Exhibition at 11 a.m. on 2nd June.

Before asking Mr. Shelley to open the Exhibition, Mr. F. W. Douglas, President, read a message of good wishes for the success of the Exhibition received from His Excellency The High Commissioner. Mr. Douglas briefly outlined the work of the Association during the past year and the main features of the present Exhibition.

Mr. Shelley reviewed recent developments affecting agriculture in Malaya. He hoped that the better position of the rubber industry caused by the new restriction agreement would not make us drift into that facile complacency with the condition of things which characterised the period preceding the depression.

Allusion was made to recent legislation concerning the Rubber Research Institute of Malaya and to the inauguration of a service of Asiatic rubber instructors who will work towards the improvement of the cultivation and produce of small rubber holdings.

In this connexion, Mr. Shelley suggested the re-introduction of competitions of small-holders' rubber at agricultural shows, which might be organised on lines similar to those of the All-Malayan Padi Competition.

Stress was laid on the value to Malaya of her other agricultural products. Of these, the vegetable oil industry and particularly with reference to coconuts, is experiencing considerable difficulties owing to the low prices for the produce. He hoped that the committee recently appointed by H. E. The Governor would find itself in a position to put forward recommendations

which would help to alleviate the position.

The improved statistical position of the local rice industry wa mentioned; the campaign to increase the area and quantity of rice grown i Malaya is now beginning to shew substantial results. It is anticipate that the acreage and yield returns of the present season will surpass th record set up last year. It is believed that the additional funds now availabl for improving present areas and developing new areas will materially assis in the further extension of the rice industry and bring Malaya perceptibl nearer self-sufficiency in the matter of rice supplies.

The speaker drew attention to recent legislation designed to improv the pineapple canning industry of Malaya; to the padi competitions hel throughout the country and to possible expansion of fruit growing.

In conclusion, Mr. Shelley stated that the work the Association i doing deserves encouragement and he therefore commended it for favourabl consideration and support.

The Hon'ble Dr. H. A. Tempany, C.B.E., Director of Agriculture thanked the Chief Secretary for having opened the Exhibition. In a shor speech he stressed the importance of the coconut and oil palm industrie and reminded his listeners that these two industries are passing through a period that is every bit as difficult as that which rubber experienced durin the blackest days of the depression.

He considered that agricultural shows play an important part in an movement for the amelioration and improvement of agriculture. The fac that this Exhibition was larger than its predecessors indicated extendin appreciation of the need for diversification of agricultural production. I endeavouring to improve the lot of the raiat, the extended planting of foo crops, combined with the production of a diversified range of money crops form the soundest policy.

Agriculture Section.

HON. SECTION SECRETARY. — MR. R. B. JAGOE.

The arrangement of the Agricultural Section was further altered o the lines found successful last year and the whole section, except for th All Malayan Padi Competition, was staged outside the main building unde a much enlarged attap shelter annexe.

Greater extent of bench was therefore possible and the general la out of the exhibits (which totalled over 4,000) was greatly improve compared with previous years.

The All-Malayan Padi Competition initiated this year in co-operatio with the Department of Agriculture was brought to an eminently successfu conclusion with the final stage at the Exhibition. A separate report of thi competition appears elsewhere in this issue. The exhibits were arrange according to States, on low tiered benches in front of the main entranc and formed an interesting and attractive item of the Exhibition.

Experience gained this first year will be very useful in developing th

competition on more fully organised lines with State quotas and in improving the manner of the arrangement at the Exhibition itself.

Group 2.—Cereals.

This was a depleted group on account of its largest class being surrendered to the large scale Padi Competition.

The class for maize was, however, a very good one, as was also the class for kampong milled rice.

This latter class included one somewhat irregular but interesting exhibit. This was a sample of what Malays call " Emping ". Under-ripe padi is harvested and is lightly baked in a kwali; then husked in a lesong, in process of which husking the under-ripe grain also gets crushed. This crushed semi-baked rice is eaten with sugar and santan or fresh grated coconut.

Group 3.—Food Crops and Products.

This group was largely composed of tapioca in various forms, and palm sugars.

The largest individual class was that for " gaplek." This has several forms, but the commonest is prepared as follows:—The peeled tapioca root is cut into 3 inch lengths and these are then cut longitudinally into small sticks about ½ inch thick; they are then usually put into boiling water for a few minutes before drying. When dried they are reduced in thickness and are thin slivers of a watery-white colour, which will keep for a long time if necessary.

If they are not dipped into boiling water they remain snowy-white in colour and are easier to make flour of, but will not keep so well.

There were, as well, large classes of pearl tapioca and tapioca flour, while arrow-root and sago were also well represented.

The Gold Medal presented by His Highness the Sultan of Selangor for canned pineapples was won by the Malayan Pineapple Factory, Klang.

Group 4.—Miscellaneous Economic Products.

This group included tea, coffee, cocoa, tobacco, gambier, kapok and ropes. Each of these was well represented, though not in all their classes.

The class for Estate tea was disappointing with only one exhibit.

The class for Asiatic tea received 70 exhibits of tea grown by Chinese (Hakka) small holders, the quality of which was uniformly quite good. This tea known by Chinese as " wild " tea is a green tea of larger leaf than the usual green Chinese tea, and is grown and consumed almost entirely by Hakka Chinese only.

The various classes for coffee beans and ground coffee were also well filled, largely by entries from Malay small-holders. The quality of these exhibits varied considerably, but the best of them were of really good quality, the only fault with many of the exhibits of ground coffee from a European point of view being that they were ground so very finely, as to

be quite powdery.

The class for " locally grown coffee prepared and packed for market " was poorly supported in point of numbers but received two entries of excellent quality. The exhibit of robusta coffee sent in by Mr. W. Aucutt, of the British Malayan Coffee Plantations, Seremban, was awarded the first prize; and Messrs. Tan Kee Sin of Klang, whose exhibit was only slightly inferior in quality, were awarded the second prize.

The different classes for tobacco were well filled, while those for cigars and native cut tobacco showed a very definite improvement in quality compared with last year.

It was interesting to find an unexpectedly large entry of cocoa pods, all of which were good sized, well filled and matured.

There were numerous exhibits of ginned kapok, the majority of which were of good quality. It was impossible to display this class satisfactorily owing to the fact that only a small proportion of the exhibits were sent in in respectable receptacles of suitable size. The matter of receptacles for all classes of exhibits is receiving attention in preparation for next year.

Group 5.—Spices.

Apart from the particularly large number of entries of arecanuts, the best classes were those for fresh ginger, fresh turmeric, and cloves. All the arecanut classes were well filled. Dried "slices" was the largest and most interesting class and showed the difference in the dried product as prepared by Malays, Chinese and Tamils.

Group 6.—Fruits.

Fruits were not as a whole as good as last year, but the elimination of a few comparatively worthless classes improved the general appearance of the group.

There were a fair number of entries of named varieties of bananas but these were almost without exception quite unripe; papayas were fairly numerous and there were fairly good classes of soursops, rambutan merah, chiku, mangoes, grenadillas, guavas and tamarind, but most of the classes for native Malayan fruits were poorly represented on account of the Exhibition being held a little before their season.

There was one exhibit of some excellent mangoes grown at Muar, Johore.

The commencement of the pineapple season was celebrated by a huge entry of rather under-ripe pineapples, Sarawak and Singapore varieties being predominant; though under-ripe the pineapples were in general of very fine size.

The numbers and quality of the exhibits in these pineapple classes are a reflex of the growing importance of the pineapple canning industry in the country.

Exhibits of citrus fruits were also more numerous than last year. The entries in the classes for oranges and lemons were of good quality, but

pomeloes did not reach the excellent standard of last year.

The Gold Medal presented by His Highness the Yang di per Tuan Besar of Negri Sembilan for the most successful exhibitor in fruits was won by Yin bin Esa, Balik Pulau, Penang.

Group 7.—Vegetables.

The general classes for vegetables were much below last year in numbers of exhibits and the majority, except for beans, gourds and sweet potatoes, were also of a lower standard of quality. Leaf vegetables were particularly disappointing.

In contrast to the general vegetable classes, those for collections of vegetables were of excellent quality.

There were fewer "collections of vegetables grown by Chinese market gardeners" but there was an increased number from School Gardens and Kampong Home Gardens, and all exhibits were of a very high standard.

The collections of vegetables "grown in School Gardens" were particularly good, which reflects the special interest taken in this form of educational work by the Department of Agriculture during the last two years and the consequent improvement in the standard of School Garden work.

There were, in addition to the above, two special displays of vegetables, one of locally grown vegetables by the School of Agriculture, Serdang, and one of hill vegetables by the Cameron Highlands' Society.

The School of Agriculture put up a most tastefully arranged display of local vegetables of very fine quality; all grown by Students of the School.

The Cameron Highlands' Society exhibited a large collection of vegetables and fruits, and made an imposing display of the possibilities of fruit and vegetable production in the Highlands. The asparagus and cabbage were perhaps their best exhibits but the vegetable marrows, citrous, rhubarb, potatoes, carrots and white turnips were also very good.

The Gold Medal presented by Mr. S. M. Sharma, for vegetables was won by Oon Beow, Segambat, Kuala Lumpur.

The Gold Medal presented by Messrs. Imperial Chemical Industries, Ltd., for the best collection of vegetables grown by a Chinese market gardener was also won by Oon Beow.

The Silver Cup presented by His Excellency The High Commissioner for the most outstanding exhibit in the Agriculture and Oils and Fats Sections was won by Mr. Aucutt's exhibit of Coffee prepared and packed for market.

Horticulture.

HON. SECTION SECRETARY. — MRS. N. C. E. MILLER.

This Section was poorly supported which must have caused keen disappointment to the Section Secretary and Committee in view of the hard work that had been put into the initial preparations.

The exhibits received, nevertheless, were of a high order and particularly outstanding was the display by the Kuala Lumpur Public Gardens.

Another noteworthy exhibit was that from Whittington Bungalow

Fraser's Hill, their cut flowers being some of the finest seen in Malaya.

Oils and Fats.

HON. SECTION SECRETARY. — MR. GUNN LAY TEIK.

A feature of this Section was the large number and excellent quality of the exhibits received from small holders in the copra class, in view of which the judges made several additional awards.

Altogether a total of 308 exhibits was received in Group 1 for smallholders of which over a hundred came from Balik Pulau, Penang, and Province Wellesley.

Group 2 for Estates and Manufacturers was not so well supported though mention must be made of the excellent quality of the exhibits of locally manufactured soap for which a new class was included this year.

Art & Photography Section.

HON. SECTION SECRETARY. — MR. E. P. HODGKIN.

As the result of the allocation to the Art and Photography section of a larger space than at previous Exhibitions, it was possible this year to display the exhibits very much better than in the past. It was unfortunate that under these circumstances there was a decreased entry. Although fewer in number the exhibits seemed to be of better quality than in previous years; in the photography group particularly there were some exceptionally fine pictures.

The Section was, this year, divided into three groups. The first for pure art work attracted six entries and these were divided for the purpose of judging into oils, water colours, black and white drawings and miscellaneous pictures. The best exhibits were in the black and white and water colour classes. A number of pictures were received too late for competition.

In the second group, photography, 45 exhibits were received for competition, amateur entries being far more numerous than professional, the latter being represented by only 13 photographs. It was found desirable in both amateur and professional divisions to make a separate class for photographs of architectural subjects, and a class for these might with advantage be included in the schedule another year.

The third group for " miscellaneous art work " was included for the first time this year. Only a few exhibits were received but they included as divergent subjects as a lino-block print, silver-work and some effective silhouettes backed by coloured silver paper. Sufficient interest was taken in this group to indicate that it might well be extended to include all craft work which does not find a place in other sections of the Exhibition.

Mr. E. J. McNaughton very kindly lent a large number of his pencil portraits of Malayan types, and also a portrait of H. H. The Sultan of Selangor. A number of sketches by Mrs. E. N. W. Oliver were also hung through the kindness of Mr. E. N. W. Oliver. These loan collections were greatly appreciated by the public.

Village Industries.

This Section was undoubtedly one of the features of the Exhibition and gained considerably from its improved lay-out. As mentioned earlier in this report, a large attap building was erected to provide more satisfactory accomodation which made it possible to effect more variety in design than has been possible in recent years.

As usual the Schools and Village Industries competitive classes were included in this Section and in addition several schools, notably the Sultan Idris Training College of Tanjong Malim, the Kuala Pilah Government English School, Bukit Zarah School of Johore Bahru and various Kuala Lumpur schools had separate stalls in which to display the handwork of scholars.

Kelantan and Selangor both again had stalls for native arts and crafts and a newcomer was Trengganu. The Selangor stall perhaps lacked the enthusiam of Tungku Laxamana, who is at present in Europe, but nevertheless made satisfactory sales, while the Kelantan and Trengganu receipts were particularly surprising and encouraging to the ladies who had travelled all the way to Kuala Lumpur to look after their stalls.

Brunei silver and sarongs were accommodated on a small stall and Malay women from Port Port Dickson had their usual stall for bag making.

Preserves and Confectionery.

HON. SECTION SECRETARY. — MRS. R. E. COX.

This Section was called the Home Section last year but the present title was considered more suitable. Separate groups for amateurs and professionals were provided and exhibits reached a very high standard of excellence. A Cookery competition was again included and an electric stove provided but disappointingly received no support.

With the exception of one Professional exhibit from Taiping and a few amateur exhibits from Selangor districts, most entries originated from Kuala Lumpur.

Entries from a distance will always be few in this Section owing to the difficulty of transport and packing. However, it is hoped that next year more exhibits will be received from outside Selangor. It is quite possible to send things safely by rail, if they are well packed and arrangements are made beforehand for their reception on arrival. More amateur entries would be acceptable in future years.

Poultry.

SECTION CHAIRMAN. — MR. A. L. SHELTON PALMER.

This Section was one of the most successful in the whole of the Exhibition and was the largest in the history of the Association. The large building provided was extremely well laid out and particular credit is due to the Section Chairman for such an outstanding Show.

A total of 582 exhibits was received drawn from all parts of the country and consisting of 192 poultry, 161 pigeons, 152 eggs, 50 canaries

and 27 cage birds.

The most popular breed was the Light Sussex with Rhode Island Reds also in evidence. An encouraging feature was the fact that about 50% of the exhibits were pure bred birds and the Gold Medal for the Best Bird in the Show was won by a locally bred Rhode Island Red entered by Mr. W Rodger of Kuala Lumpur.

An outstanding exhibit was a collection of pure bred birds from Singapore entered by Mr. Letondu for which a special award of a silver cup was made.

Mention must be made of the Pigeon sub-section in which the Section Chairman was considerably helped by Mr. E. W. Cooke as in former years. Pigeon fanciers seem to be rapidly increasing in numbers and their keenness can be gauged by the interest taken each year in the Exhibition.

Cats.

HON. SECTION SECRETARY. — MRS. A. L. SHELTON-PALMER.

The Cat Show was as usual a feature of the last day of the Exhibition and attracted great interest. There were 44 entries, the largest on record. Pure bred Siamese cats form a prominent class at this annual show. In view of the excellence of this breed in Malaya and of its popularity in other countries it is surprising that the commercial aspect of Siamese cat breeding does not receive greater notice in this country.

Pigs.

HON. SECTION CHAIRMAN. — MR. V. L. CACHEMAILLE.

There were about 40 exhibits in the Pig Show, a slight increase on last year's entries. There was a considerable improvement in the standard of the exhibits. Most prizes were taken by Chinese pig "feeders" rather than "breeders," who in Selangor—from which State all exhibits were derived —make full use of the pure-bred stock at the Government Stock Farm for crossing with local breeds.

Of cross-bred exhibits the best were Berkshire x Chinese Sow, and Large Black x Poland-China.

Cattle.

HON. SECTION SECRETARY. — MR. E. W. COOKE.

This is the first occasion for some years that cattle have been included in the Exhibition. Owing to difficulties of transport and expense to the owners, Selangor provided all the entries. The Section was extremely successful and it is hoped that the organisers will be able to extend it considerably next year.

Needlecraft and Handwork Section.

HON. SECTION SECRETARY. — MRS. M.DUKES.

This Section was subdivided this year into Group 1 for hand work and Group 2 for machine work.

Group 1. Handwork.

Exhibits came from Singapore, Penang, Province Wellesley, Pahang,

Kelantan, Perak, Selangor, Malacca, and the work was representative without too much duplicating of articles from any one Exhibitor. One outstanding piece of work which obtained a special medal, was a patchwork bedspread made of 1,000 pieces of cloth each one handsewn.

Group 2. Machine Work.

HON. SECTION SECRETARY. — MRS. E. P. HODGKIN.

The machine work section was very much larger than in previous years and, apart from three exhibits, was sent entirely through the Singer Sewing Machine Company. There were approximately 300 exhibits from all parts of Malaya. Singapore, Penang, Malacca, Ipoh, Kampar, Teluk Anson, Seremban, Kelantan, were all represented.

The schedule was divided into four classes which were again subdivided. The variety of work was very large and the judges found the judging, especially in Class 430 (Embroidery) difficult.

Among a number of excellent pieces of work a picture from Kampar was outstanding and received a special award as did also a chain-stitch bedspread from Singapore. All prizes were given by the Singer Sewing Machine company who also kindly helped with the work of packing after the Exhibition.

Trade Section.

The Trade Section this year filled nearly the whole of the main permanent building and stalls were extremely attractively decorated. Business done was quite considerable, the three motor firms represented, all booking numerous orders, a certain sign of the times.

A silver cup donated by the Oversea-Chinese Banking Corporation was awarded as first prize to Messrs. The Imperial Chemical Industries (Malaya) Ltd., whose stall, in the opinion of the judges, was the most outstanding in the Section. The principal feature of the stall was a large back panel in ply-wood, painted and arranged in varying planes to show a rubber estate and smoke-house against a typical background of hills. Mr. E. J. McNaughton, who designed and painted this scene, is to be congratulated on its effectiveness.

In awarding a gold medal to Messrs. The Federated Engineeering Co. Ltd., the judges took into consideration, in addition to the excellent display of locally made rubber machinery, the large model sheeting battery and model of a combined hot air drying and smoke house exhibited in the Rubber Research Institute Buildings.

Numerous other awards were made for display and quality of exhibits.

Government Departments.

Department of Agriculture, S.S. & F.M.S.

The Department staged a series of instructional exhibits in the permanent building which they share with the Rubber Research Institute of Malaya. The following account illustrates the scope of the display.

In view of recent work aimed at the improvement of native-produced

copra, exhibits shewed the system of copra-grading, types of copra and models of improved copra kilns suitable for production of high grade copra from small-holdings. In addition, products manufactured from copra were shewn.

A comprehensive series of varieties of pure strain padi, produced by the Department and suitable to the varying conditions obtaining in Malaya was displayed—a collection which never fails to attract and interest Malay visitors.

Under fruit propagation, exhibits were designed to bring to notice budding and etiolation methods.

Another series of exhibits which proved of great interest were concerned with the production of the tea at Cameron Highlands. Chests of tea of different grades, information on London sales, valuation of grades and comparison with prices of tea produced in other countries, enabled the visitor to review at a glance the present position of the work of the Department in this direction.

A section of the display was concerned with poultry. Models of improved types of poultry houses were shewn, which incorporated the most recent recommendations of the Department and are especially designed to be of use in small holdings. Other exhibits in this section were drinking fountains, food troughs and trap nests. A series of wall illustrations shewed the proper methods of handling poultry and the desirable characteristics to look for in selecting and judging poultry and observing the condition of the birds.

Recent legislation in the Straits Settlements, Johore and the Federated Malay States in connexion with the introduction of measures designed to stabilise and improve the valuable canned pineapple trade in this country led the Department of Agriculture to stage exhibits illustrative of its investigations on this crop in the field, and to display samples with special reference to the proposed grading scheme. In addition, canned pineapples from countries which were actual or potential competitors with the Malayan product were shewn.

Samples of locally manufactured tobacco were staged, together with exhibits shewing different types of leaf and a model flue-curing barn.

A stall was also allotted to the display of milk from the Government Stock Farm, Serdang, with graphs illustrating its high degree of purity. Samples of fodder grasses and locally-produced feeding stuffs for cattle were also included in the exhibits.

The School of Agriculture, Malaya, occupied a stand in which were shewn the work of the School, the courses of instruction and the life of the students at the School, illustrated by a cinema film. Mention should also be made of the very fine exhibit of agricultural products grown by the students at the school, which was included in the Agricultural Show.

Co-operative Poultry Products Ltd.

The Co-operative Societies Department staged an exhibit of the

apparatus used by this Union of Co-operative Egg-Collecting Societies for testing and grading the eggs which are being marketed in several towns of the Peninsula.

In this exhibit explanation and demonstration was given of the methods of candling eggs for freshness and of grading eggs for size and weight. The explanation was supplemented with diagrams and illuminated photographs.

The apparatus on show was similar to that used by the various Co-operative Societies affiliated to this marketing organisation. For nearly three years the Societies have been running efficiently and the apparatus is used by peasants with uniform and satisfactory results.

The Society operates from the Krian District of North Perak where the eggs are collected, candled, graded and packed. The Society has made arrangements for the sale of its eggs in Penang, Parit Buntar, Ipoh, Teluk Anson and Kuala Lumpur.

Rubber Research Institute.

The exhibits staged by the Rubber Research Institute may be conveniently divided into (a) Botanical (b) Pathological (c) Chemical and Technological, including especially the application of latex to new uses.

All of the exhibits were intended to illustrate the principal activities of the Institute at the present time. These exhibits also form the nucleus of a collection which is being sent shortly to London for an exhibition to staged by the Rubber Growers' Association, London, in the Science Museum, Kensington.

BOTANICAL SECTION.

The exhibits of the Botanical Division comprised a comprehensive series of charts and diagrams with accompanying narratives to illustrate the yields of budded rubber trees in comparison with yields of seedlings. An excellent series of enlargements of microphotographs of the latex bearing tissues of high, medium and low yielding trees was shown, in order to demonstrate differences which it is hoped may constitute a method of selection of high yielding planting material.

In addition, charts, models and explanatory narratives were exhibited to illustrate the results of a number of experiments with different systems of tapping which are being conducted by or under the auspices of the Division on areas under the control of the Institute and on various estates.

PATHOLOGICAL SECTION.

The exhibits of the Pathological Division of the Institute were designed to illustrate the work in progress on (a) Root diseases of the rubber tree (b) *Oidium Heveae* leaf disease and its treatment.

In relation to (b) the exhibit was staged in a manner to demonstrate the parallelism in mode of action of the three principal root diseases of the rubber tree in Malaya, viz. White root disease, Red root disease and Brown root disease caused respectively by the fungi *Fomes lignosus, Ganoderma pseudoferreum* and *Fomes noxius.*

Specimens of the mycelium, rhizomorphs and fructifications of the three fungi on rubber roots and on jungle stumps in the soil, which constitute the primary source of infection, were exhibited.

The lay-out of the exhibit with accompanying narratives and labels was in a form which demonstrated the similarities in these fungi especially in relation to their mode of attack and spread and to illustrate the methods of treatment in areas of both young and mature rubber trees. The exhibit especially demonstrated that, in relation to treatment, all three fungi can be considered as aspects of a common root disease problem.

In relation to the leaf disease caused by the fungus *Oidium Heveae*, the exhibits consisted of enlargements of microphotographs of the fungus on the leaf, living specimens of the fungus on the leaf which could be examined under a microscope, enlarged photographs showing methods of sulphur-dusting on estates, together with four of the principal machines which are in use in Malaya and elsewhere for the sulphur-dusting method of treatment of the disease, together with several commercial types of sulphur powder which have been applied.

The various exhibits were accompanied by suitable explanatory narratives.

CHEMICAL AND TECHNOLOGICAL SECTION.

The exhibits staged in this section can be conveniently divided into three, viz.

(a) Samples of white and discoloured latex and specimens of various non-caoutchouc constituents of latex.

(b) A complete lay-out of a modern estate sheeting factory including a new type of combined drying and smoking chamber.

(c) Numerous specimens of rubber articles manufactured direct from latex.

In relation to (a) the exhibits of latex demonstrated one of the principal defects of latex on the market, viz. discolouration caused by contamination with iron from containers or collecting vessels. Investigations carried out in the Institute have demonstrated the close relationship between such discolouration and the stability of the latex since the discolouration develops in the presence of hydrogen sulphide and the acids (chiefly lactic acid) formed when latex decomposes.

Incipient decomposition affects the stability of latex, so that the prevention or reduction of such decomposition not only reduces the discolouration but also improves the stability of the latex.

Several non-caoutchouc constituents isolated from latex, including pure quebrachitol, were also exhibited. Some excellent samples of sheet rubber prepared at the Institute from ammoniated latex by using a special coagulant were also exhibited.

In relation to (b) a complete model estate sheeting factory, including settling and coagulating tanks, a six machine line-ahead sheeting battery

and new combined drying and smoking chamber designed at the Institute and constructed by the Federated Engineering Co., Ltd., was exhibited. The model line-ahead sheeting battery was also designed by the same company while the model tanks were constructed by Diethelm & Co., Ltd., Singapore.

The combined drying and smoking chambers embody the principle of separate and controlled drying and smoking of sheet rubber in a period of 48 hours. Drying is effected by circulation of hot water in a system of pipes attached to a domestic boiler or water heater.

Each chamber is of single storey and the rubber is placed on racks on trolleys after being subjected to preliminary dripping on special racks under shade before entering the heated chambers. The smoke is produced by a separate smoke box or furnace. In order to obtain smoked sheet of a good brown colour, the total period of smoking is only 3 hours out of the total drying period of 48 hours for sheet of not more than $\frac{1}{8}$ inch thick. Air dried sheet can be prepared in such chambers if required.

In relation to (c) the exhibits included the following articles made direct from latex or in which latex is applied—carpets and upholstery material and imitation leather in which Revertex or other forms of concentrated latex are used as adhesives or in admixture; sponge rubber seats and other "sponge" articles (Dunlopillo) manufactured by the Dunlop Rubber Co. from Dunlop centrifuged latex; Hairlok—an upholstery product made by treating horse (or cattle) hair with vulcanized latex; paper pulp and decorative cardboard products containing latex and bags, baling cases and other articles made in Ceylon by treating hessian (jute) with vulcanized latex; rubber gloves and similar articles made from latex; metals and wood coated with vulcanized latex; a rubber globe map of the world. In addition a number of samples of rubber flooring made by leading rubber manufacturing firms in Great Britain and also several types of rubber buckets were exhibited.

The Post & Telegraphs Department Exhibit.

The comprehensive exhibit staged by the Posts and Telegraphs Department was extremely interesting and demonstrated the latest practice in automatic telephone plant.

In the centre of the stand was the complete automatic exchange which is to be installed at Ampang and attached to it was an electrical robot, a very ingenious, facinating, and weird " box of tricks."

The mere operation of a knob caused the test of all subscribers line switch equipments one after another in an amazing fashion. The switch under test was indicated by a white lamp, but should the switch prove to be defective a red warning lamp was substituted and a bell operated.

Still more intriguing was the section of the robot which tested the switches over which the subscribers normally dial their numbers.

The selectors were chosen in turn and the robot dialled numbers to them. The selectors rose, rotated, and released without human aid.

The numbers sent out were counted and only when the selector under test was proved to be functioning correctly was it dropped and the next one taken into use.

Should a fault exist the white lamp relative to the selector undergoing test changed to green, the humming and buzzing of the apparatus in the " trick box " abruptly stopped and the bell rang.

Another exhibit was a smaller Rural Automatic Exchange and is a sample of those to be installed at Sungei Besi, Puchong and other places in Malaya. Telephones were connected to it and its operation could be observed.

With the exception of the Automatic Unit the remaining exhibits had been designed and constructed locally by the staff of the Posts and Telegraphs Department.

Practical demonstration of underground telephone cable jointing was exhibited in a sectional brick built man hole. Jointing continued throughout the exhibition. The multifarious types of cables and joints utilised in present day telephony were on show.

A Post Office with Public Call Office and all regular postal facilities was provided.

Selangor Medical and Health Department.

The Medical and Health Department, Selangor, have their own building in the Exhibition grounds. A comprehensive range of exhibits including Infant Welfare and General Hygiene and Sanitation, Malaria Prevention, Control and Treatment and Social and Dental Hygiene served adequately to demonstrate modern methods of preventive medicines. Explanatory cards in the various languages were attached to each exhibits

INFANT WELFARE SECTION.

In this section, models, pictures and posters on maternity, infant and child welfare—ante-natal and post natal, were shown. Feeding and the preservation of food, dress and infant and maternity hygiene were amply exhibited.

An exhibit which created much interest was Soya Bean Milk as a substitute for tinned milk in feeding infants.

Practical demonstration lectures were given during the Exhibition each morning and afternoon.

ANTI-MALARIAL SECTION.

This section included five large working models illustrating anti-malarial control in all its branches and two films were also exhibited at intervals, showing new methods of oiling which are now in use in Kuala Lumpur and general measures of mosquito control.

Another interesting model showed control by Paris Green. There were numerous posters, diagrams and exhibits dealing with malarial control in all its branches.

GENERAL HYGIENE AND SANITATION.

Methods of control in the commoner diseases were indicated and models and diagrams showing village sanitation, protection of estate water supplies, clean food, particularly milk, production and conservancy and refuse disposal were exhibited.

Social and Dental Hygiene was illustrated by lantern slides, models and charts.

As in previous years, much public interest was manifested and there is little doubt that the Exhibition furnishers each year an excellent opportunity to further public health propaganda.

Federated Malay States Railways.

The Railway Administration exhibited a section of a second class coach complete with fittings, lighting, etc., showing separate compartments provided for day and night travel respectively, depicting carriages formed on the ordinary trains. The compartment for night travel was fitted up with comfortable mattresses, pillows, and mosquito curtains, similar to the accommodation which is ordinarily provided on the night mail trains.

In addition to the above, a number of attractive coloured posters published by the Administration were displayed on the stand and Railway representatives were in attendance distributing free literature and supplying information in reply to enquiries in regard to transportation.

The Electrical Department.

The Electrical Department had an attractively decorated stall of electrical equipment and contrivances suitable for general use in the home.

The Department very kindly gave considerable assistance with the lighting arrangements of the Exhibition and in providing floodlighting in the Stadium.

Young Women's Christian Association.

The Y.W.C.A. again organised a rest room very efficiently which was much appreciated by lady visitors to the Exhibition.

Catering and Amusements.

The principal catering arrangements were once more in the hands of the Majestic Hotel and tea dances and cabaret performances were given each day.

Restaurants providing Chinese and Mohamedan food were also available.

The Selangor Football Association assisted greatly by organising a knock-out football competition for which the Malayan Agri-Horticultural Association offered a cup and medals to the winning teams and runners-up. Four teams took part, the Chinese, Tamils, Malays and the Rest, the Tamils proving victors and the Chinese runners-up. The British Resident, Selangor, the Hon'ble Mr. T. S. Adams, M.C.S. presented the Cup and medals on the last day.

An innovation was a Bicycle Carnival staged each night in the Stadium under flood-lights which drew a large crowd of spectators. This carnival was organised by the Selangor Cyclists' Association and thanks are due to that body and to Messrs. Marcus and Bothaju, who were personally responsible.

On the last night of the Exhibition Mrs. H. A. Tempany very kindly presented the prizes to the successful entrants.

Another popular attraction was a Badminton Tournament organised by Mr. Bothaju and a Committee of helpers for which a very large entry was received.

A circus and side shows in the grounds appeared to be well patronised though rather adversely affected by the rain.

Cinema.

As in past years, the staff of the Rural Lecture Caravan showed the propaganda films of the Agricultural, the Co-operative and the Health Departments.

An innovation was introduced this year. By means of a large ground glass screen, daylight shows were given both morning and afternoon at 11 a.m. and 4 p.m. respectively.

This screen was also used by officers of the Agricultural Department to give lectures on poultry illustrated with lantern slides. The advantage of this arrangement is that the lecturer can be seen by his audience and can himself see his audience whilst giving the lecture. Attendances at these daylight shows were rather poor because the public has not yet become accustomed to the times of daylight shows and it will be necessary to advertise more vigorously on future occasions.

The continuous evening film shows commencing at 7 p.m. were, as usual, very well attended.

Traffic.

Tribute must again be paid to the Chief Police Officer, Selangor, and his officers, who personally supervised traffic arrangements which were particularly efficient and smooth running. This year the Police kindly extended their plans to permit of cars being called to the main entrance for visitors which was a great and much appreciated convenience.

As in previous years the Malayan Agri-Horticultural Association is indebted to the Boy Scouts for the very great help which they rendered throughout the Exhibition.

Miscellaneous.

THE ALL-MALAYAN PADI COMPETITION. *

The first All-Malayan Padi Competition came to a satisfactory conclusion with the final stage, or Central Competition, which was held in conjunction with the recent Eleventh Malayan Exhibition.

The reasons leading up to the inauguration of this competition together with the rules governing it, have already formed the basis of an article in this Journal†, and it is here only necessary briefly to recapitulate the salient points.

The competition is divided into two parts: the local or district competitions and the Central Competition at the Annual Exhibition of the Malayan Agri-Horticultural Association in Kuala Lumpur.

Exhibits, consisting of three gantangs (Imperial gallons) of padi, must be of a strain approved for entry in the Competition and must bear a statement giving the locality of the holding and size of the area from which the padi was drawn together with a certificate of yield.

Only the three best exhibits from each local competition are admitted to the Central Competition which, consequently, should comprise the best padi in Malaya.

The general response to the competition was extremely satisfactory and encouraging, the scheme being taken up with considerable enthusiasm in the districts throughout the Federated Malay States and the Settlements of Penang and Malacca. As evidence of this it may be recorded that in Negri Sembilan,thirty-five local shows were held. With such a large number of minor competitions, further selection was necessary and actually some fifty exhibits were entered for the Central Competition.

A report on these local competitions in Negri Sembilan shows that they have attracted considerable attention and that in some centres, more particularly in the District of Kuala Pilah, the quantity and quality of the samples submitted were of a satisfactory order and competition was keen.

The report points out, however, that the general appearance of the padi bore unmistakable evidence of a wet harvest which was reflected in the presence of immature and undeveloped, and also in many cases, mouldy grain. The almost universal presence of grain moth and weevil was also an indication of insufficient drying prior to storage. It is anticipated that the changes in planting dates arranged in most districts for the forthcoming season, will result in heavier yields and sounder grain.

* Reprinted from the *Malayan Agricultural Journal*, Vol. XXII, No. 7, July 1934.

† *Malayan Agricultural Journal*, Vol. XXI No. 12, December 1933.
M.A.H.A. Magazine, Vol. IV No. 1, January 1934.

In Perak a proposal to hold a State Agricultural Show in Kuala Kangsar on May 10th, the birthday of H.H. The Sultan of Perak, made it possible to give particular prominence to the competition. Twelve local shows were held and care was taken that the number of such shows in each District should be in approximate proportion to the area of padi grown.

The three prize-winning exhibits from each local show were sent to the State Show, and were also eventually entered in the Central Competition, in accordance with the rules. The State Show thus served as a supplement to the Central Competition and did much to stimulate local interest.

Some 160 exhibits were received for the Central Competition and were suitably displayed at the Eleventh Malayan Exhibition. Preliminary judging on the day before the Exhibition reduced the number of possible winners to forty, from which twelve were selected for final consideration after prolonged and careful judging.

The exhibits reached a particularly high standard of quality which can be gauged by the fact that the judges were occupied for four hours in dealing with the selected forty exhibits, the final twelve being subjected to further very careful scrunity and tests before the six awards were made.

Judging was carried out on a basis of 100 marks, allotted as follows:—

1.	Purity of sample	30
2.	Type of grain	20
3.	Condition and uniformity of ripeness ..	20
4.	Condition and uniformity of grains ..	10
5.	Weight per volume	10
6.	Cleanliness	10
		100

Purity of sample is most important as it denotes understanding and care in the selection of seed. An unduly impure sample is eliminated immediately. Items 2 and 3 also apply to preliminary judging more particularly, condition and uniformity of ripeness being an important point as indicating whether the padi ripens evenly and quickly and thus can be harvested rapidly.

The first prize was won by a sample of a high-yielding variety of padi, known locally as "Mayang Sa-Batil," from Balik Pulau, Penang. The grain of this variety is broad, plump and of medium length, with a moderately thin white husk. The sample was remarkably free from blemishes, even in size and ripeness and of high density.

This strain of padi is well established in Penang Island. Part of the sample is being used by the Department of Agriculture for planting at the local Padi Test Station during the present season in order to produce material for pure line selection.

The second prize was awarded to a sample of the high-yielding pedigree

strain Siam 29 from Malacca. This is a locally selected strain of a variety very popular and widely grown in Malacca. It is a padi maturing in about six months, having a long, somewhat slender, cylindrical grain with a thin white husk. It has a good flavour and is of good type for milling.

The third prize was awarded to a sample of the well known Radin variety from the Kuala Kangsar District of Perak. This was almost certainly derived from the pedigree strain Radin 4 which has a slightly humped, fairly broad grain of medium length, with a reddish brown husk. Radin 4 is a strain of padi maturing in about 7 months and giving a high yield of grain.

The fourth prize was won by a sample of Radin from the Raub District of Pahang, while two samples of Serendah Kuning from the Kuala Pilah District of Negri Sembilan won the fifth and sixth prizes. This latter variety is very popular in the District but has not yet been subjected to pure line selection. The grain of the prize winning samples was, however, fairly even in size, uniform in type and of good quality.

It is noteworthy that awards were fairly evenly divided amongst the competing States, thus implying general excellence of the padi entered for competition.

A further point of interest is that one outcome of the Competition has been to encourage the holding of District Agricultural Shows in conjunction with the district padi competitions. Thus, Agricultural Shows for various kinds of agricultural products and local handicrafts were held at Balik Pulau, Bukit Mertajam, Telok Anson and Temerloh in the six weeks immediately preceding the Malayan Exhibition.

Although there were on this occasion no exhibits from any of the Unfederated States, the inability of these States to participate was due, in part at least, to the comparatively short period available for organising the competition. Arrangements, which include the distribution of some 4000 gantangs of seed of pedigree strains of padi selected at the Telok Chengai Station from popular local varieties, have already been made for the participation of the State of Kedah in next year's Malayan Competition. It is hoped that certain of the other Unfederated States may also be able to send exhibits next year.

In conclusion, it can fairly be claimed that the competition was an unqualified success and achieved its objects, in that it has stimulated interest throughout Malaya in padi planting and has ensured that the prize winning exhibits at the Malayan Exhibition definitely represent the best padi in Malaya.

District Agricultural Shows.

Lower Perak Agricultural Show.

The Lower Perak Branch of the Malayan Agri-Horticultural Association held an Agri-Horticultural Show at Teluk Anson on 28 April, 1934. In the absence of H. H. The Sultan of Perak the Show was opened by The Hon'ble The Raja Muda of Perak, C.M.G., M.F.C.

The Schedule contained 162 classes divided into 9 Sections.

Many exhibits were of a good standard, but also many fell short of exhibition standard—possibly on account of the fact that no show has been held for some years past.

One hundred and sixteen entries were received for the All-Malayan Padi Competition from which three samples were selected for competition at the State Padi Show and for subsequent despatch for competition at the Eleventh Malayan Exhibition.

The Village Industries Section was well supported and contained a large variety of articles of good workmanship.

The Department of Agriculture staged an exhibit of padi, copra and tea. The Drainage and Irrigation Department staged a model of the first section of the Sungei Manik Irrigation Scheme, an exhibit that attracted considerable attention. The Health Department staged a well-arranged exhibit and organised a Baby Show. The Sultan Idris Training College displayed a wide range of various articles, from attractive lamp shades to specimens of the soap manufactured by the College. The Teluk Anson Malay School also displayed good specimens of its pupils' work, including paintings and hand-work of various sorts.

Not only was the Show well supported in the matter of entries, but it was well attended throughout the day. The Hon'ble the British Resident attended the Show and distributed the prizes in the afternoon.

Bukit Mertajam Agricultural Show.

This show was organised by the District Economic Board, Province Wellesley under the Chairmanship of the District Officer, Province Wellesley. and was held on the 20th & 21st April 1934 in the hall of the High School.

Owing to the very large number of entries in the All-Malayan Padi Competition, preliminary judging was carried out in the small-holdings, any manifestly bad samples being rejected. Even so, upwards of 100 samples of padi were exhibited at the Show. The general quality was only average and did not compare well with the standard in Penang.

In the preliminary judging in the kampongs it became evident that many of those who entered for competition had very little idea of the type of sample required and one of the Departmental exhibits was accordingly designed to illustrate this point.

Agricultural and other produce was exhibited in 90 classes, arranged in 8 Sections. The general standard of the agricultural exhibits was very good and it is anticipated that if a similar show is held next year, the number of entries will be greatly increased, since great local interest was aroused by this event.

The Department of Agriculture displayed samples of padi with descriptive cards indicating the qualities to be aimed at for the purpose of the All-Malayan Padi Competition, and also samples showing defects in padi (lack of uniformity, awned grains), (b) mushroom cultivation, illustrated by photographs of the construction of mushroom beds, samples of fresh mushrooms, dry mushrooms and spawn, apparatus for the preparation of dried mushrooms and a placard indicating that the actual beds were on view at Bukit Merah Padi Test Station (c) Rat Destruction illustrated by specimens of traps, poisons, together with photographs of rat hunts and descriptive placards. The Health Department had an extensive series of exhibits devoted to rural hygiene.

About 2000 people attended the Show and local opinion is extremely favourable to the holding of a similar event next year.

Temerloh Agricultural Show.

The Agricultural Show and the Padi Competition for the year 1934 were held simultaneously on the 19th of May, 1934 at the Temerloh Club premises. His Highness the Sultan of Pahang was present.

The programme during the Show included water and field sports, drill competition and the soccer final for the Malay School boys. In the evening a ronggeng, open air cinema and side shows were displayed on the padang.

The Agricultural Section was divided into four groups for padi and rice, vegetables, fruits and miscellaneous exhibits, such as cakes, pickles, kapok and tuba. A very satisfactory number of exhibits was received in each group.

Sections were also provided for village industries and poultry and eggs and again the number of entries was most encouraging.

Kelantan Agricultural Show.

The second Agricultural Show held in Kelantan took place on Saturday May 19th at the Central Experiment Station, Kota Bharu.

The number of classes was increased from last year from 30 to 41, these being divided into six sections one of which was devoted to exhibits from schools.

The Land Offices at Kuala Krai, Kota Bharu, Pasir Puteh, Pasir Mas and Bachok were the collecting centres for exhibits from those districts, and arrangements were made for them to be brought by lorries to the Central Experiment Station on the evening prior to the Show.

Judging started at 9.30 a.m. and at 10.30 a.m. His Highness The

Sultan accompanied by H. H. The Raja Kelantan visited the Show and was conducted round the different sections by the Hon'ble The Acting British Adviser and the Principal Agricultural Officer. His Highness displayed keen interest in the various exhibits and particularly in the exhibit of the Department of Agriculture, Kelantan, which consisted of the improvement of native rubber, fodder grasses, copra improvement, results of experimental work on padi and demonstration of plant propagation.

After the departure of His Highness the Show was thrown open to the public and throughout the day the attendance was extraordinarily good.

With the exception of section 5 Miscellaneous, all Sections were well filled and the standard of the winning exhibits was very encouraging considering it was only the second time that an Agricultural Show had been held in Kelantan.

At 4.30 p.m. the Hon'ble The Acting British Adviser distributed the prizes. The Malayan Agri-Horticultural Association kindly presented six medals and six diplomas. Five medals were awarded to the best exhibits in each section and also a certificate to the best exhibit from Schools. A silver medal was awarded to the Penggawa, Peringat whose daerah obtained the greatest number of prizes.

The Show was most satisfactory and an even larger number of exhibits would have been obtained had not Penggawas in certain daerahs been much occupied at the time as a result of Rubber Restriction.

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EDITORIAL.

For some years the Malayan Agri-Horticultural Association has been labouring under the disability of not being able to meet its financial obligations in reference to the annual interest due to the debenture holders of the Association.

Certain payments on account have been made but the result has been that each year the Balance Sheet of the Association has shown increasing arrears of interest outstanding and it has been impossible to make any provision for the subsequent redemption of the debenture issue.

Such a state of affairs could only be considered extremely unsatisfactory, both from the point of view of the debenture holders and from that of the Association. Accordingly, Mr. F. W. Douglas, the President of the Association, drew up a scheme for the revision of the debenture terms; and, after ascertaining that it met with the approval of the majority of the debenture holders, a special meeting of the latter was called to give the necessary formal sanction to the issue of new debentures under the amended terms and conditions.

Details of these terms are contained in the report of the meeting published in the present number. It will be seen that they constitute very generous concessions on the part of the debenture holders and the Association is keenly appreciative of this fact.

The Association is placed on a sound financial basis and able to face the future with confidence. It can now hope to develop and play its part even more fully than hitherto in the agricultural life of Malaya and thus achieve the objects for which it was founded.

Malayan Christmas Hampers.

Full particulars are given in this number of the scheme organised by the Malayan Agri-Horticultural Association for the supply of Christmas Hampers of Malayan products to relatives and friends at Home.

The scheme was an undoubted success last year and is a serious attempt, in admittedly a small way, to make Malaya and Malayan products more generally known in Great Britain and also, incidentally, to residents in Malaya.

Because, with the coming of restriction, the rubber industry is once again raising its head as the major industry of Malaya, it is no reason why other crops, which have been receiving more attention in recent years, should retire into obscurity and be forgotten.

Our aim should be to make Malaya more and more self-supporting and to go a step further by exporting where possible. Malayan tea is now regularly quoted on the London market; canned pineapples have been exported in large quantities for some years, the fruit being now grown as a sole crop in large areas instead of as a catch-crop as formerly.

Local production of coffee has probably not yet reached the point of exceeding local demand which, we believe, steadily increases, and the award of the High Commissioner's Cup to an exhibit of coffee at the recent Malayan Exhibition shows that the quality of this product is improving.

In many other directions also local producers are waking up to the fact that Malaya is a country of great possibilities. Let us then do our part and adopt as a slogan " Buy Malayan First."

Horticulture.

CONIFERS

BY

R. E. HOLTTUM, M.A., F.L.S

Director of Gardens, S.S.

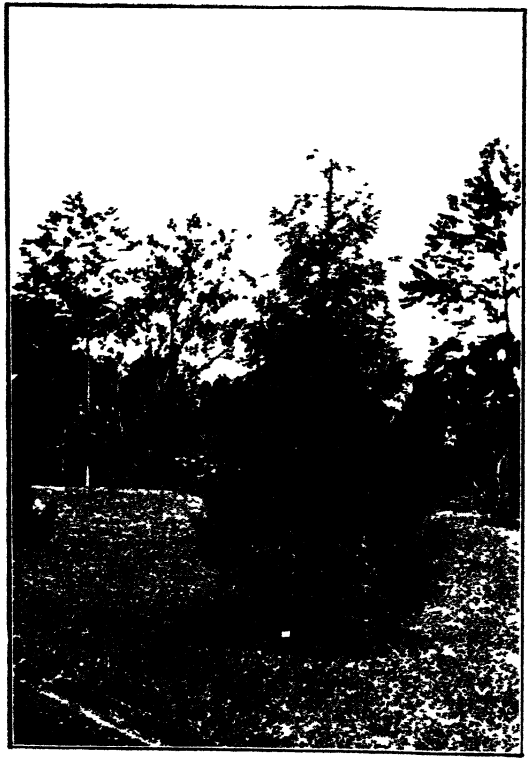
The trees usually known as conifers (pine, fir, cypress) are the dominant group of a larger assemblage of plants which are distinguished from true flowering plants in not having their seeds in closed fruits, but usually naked upon the scales of cones (whence they are called Gymnosperms or naked-seeded plants). The other groups of Gymnosperms are the Cycads (palm-like plants with stiff leaves and large cones, two species being native in Malaya and often cultivated), the Chinese Maiden-hair tree *(Ginkgo biloba)*, and a group of three genera: Gnetum (mostly climbing plants, a number being native in Malaya), Ephedra (small-leaved bushy shrubs of warm temperate regions) and the very curious two-leaved Welwitschia, a plant of the deserts of south-west tropical Africa.

The typical conifers bear their seeds on the surface of scales which are arranged in the form of a cone; the cones vary much in size from those of some of the true pines to the small cones of the cypresses and the berries of junipers (which are the result of the fusion of a number of fleshy cone-scales). There are some conifers however which have no true cones but bear their seeds singly on modified leaves. In this group come the genera Dacrydium and Podocarpus, both represented in the Malayan flora. The pollen of all conifers is produced in little sacs on scales arranged in small (usually slender and elongated) cones; these scales are exactly comparable to the stamens of flowering plants. Fertilisation is usually brought about by the wind blowing the pollen from ripe male cones to the young female cones, which have some mechanism for allowing the pollen to reach the young seeds. Trees may bear male or female cones only, or both.

There are few conifers native to Malaya, and these mostly mountain plants. There are two species of Agathis, three of Dacrydium, and five of Podocarpus; of these the only lowland plants are *Podocarpus polystachyus*, which grows near the sea and the rather rare *P. Blumei*. It is possible to cultivate some of the mountain species in the lowlands, the most successful in Singapore being *Podocarpus imbricatus*. In addition, a number of conifers from other countries have been introduced, some of which are enumerated below; many of these never produce seeds, but some may be propagated by cuttings. Their regular symmetrical form of growth makes most of them valuable garden plants where formal effects are desired.

Agathis.

This is an important genus widely distributed in Malaysia and



Young Tree of *Cupressus Knightiana*.

Young Tree of *Araucaria Bidwillii*.

Young Tree of *Araucaria Cunninghamii*

Group of Araucarias.
A. Cunninghamii in centre

Australasia. The species are all very similar and are characterised by having broad flat leaves. They yield valuable timber and also abundantly a resin used for making varnishes. In New Zealand is *A. australis* (the Kauri Pine), in Queensland *A. robusta* (the Queensland Kauri), in Fiji *A. vitiensis*, and throughout the Malayan region *A. alba* (Damar minyak); there are a few other species of less importance. In the Singapore Botanic Gardens are a number of trees of Agathis, and apparently all are from seeds received from Brisbane and Rockhampton; they should therefore be *A. robusta*, the Queensland Kauri, but some of them show a close resemblance to *A. vitiensis*. The earliest introductions were in 1875, and the trees are now 60 feet or more in height. The trunk is very straight, with numerous close branches which curve upwards and give a narrowly conical outline to the tree. The lower branches fall off naturally as the tree grows older. The bark flakes off in small irregular patches which leave a pattern of scars all over the trunk. There is a copious exudation of resin wherever the tree is cut. The leaves are usually about three inches long by one inch wide, narrowed gradually to both ends, the apex not usually acute, the surface smooth and covered with fine close longitudinal grooves, the texture stiff and leathery. Several of the trees have produced cones, which are somewhat oval in shape, the scales smooth and closely overlapping, falling separately when the seeds are ripe. The male cones, borne on separate trees, are cylindrical and about two inches long.

The Malayan species, *A. alba*, Foxw., is found in mountain forests from 1,000 feet elevation upwards. Under favourable conditions it grows into very large trees 150 feet in height. There is no record of this local species ever having been brought into cultivation in Singapore. Foxworthy reports difficulty in growing seedlings at sea level. In Java the species is used with great effect for roadside avenues, near Soekaboemi and elsewhere, at some 2,000 feet above sea level. There are three fine illustrations of it in Foxworthy's *Commercial Timber Trees of the Malaya Peninsula*, pages 183-185

Araucaria.

This group of trees, allied to Agathis, is found to-day in the southern hemisphere (South America and Australasia). One species, the monkey puzzle (*A. imbricata*), from Chile, is well known in English gardens. In Singapore four of the Australasian species are in cultivation. One of these has relatively broad flattened leaves, like those of the monkey puzzle, but smaller; the other three have small curved needle leaves, all very much alike, but the trees may be distinguished by their mode of branching. All the trees have an erect trunk with lateral branches in groups (whorls) at more or less regular vertical intervals; in some, the trunk tends to be more or less curved. None of the trees bear cones in Singapore, and none grow to the full size they assume in their native climates. On the mountains in Java they form large trees, and would do the same at our Malayan hill stations. The following descriptions are based on trees growing in Singapore.

Araucaria Bidwillii, Hook. Bunya-Bunya. Queensland.

The trunk of this species is usually quite erect, without any tendency to curvature; the height of trees in Singapore is about 40 to 50 feet. The bark of old trees is flaky; on young trees it is smooth with warty protuberances. The branches are slender and are borne in whorls close together; all droop in a curve, the lower ones most steeply, the ends of the branches curving upwards again. The leaves are unstalked, very stiff, flattened, usually about half an inch long (sometimes an inch), broadest near the base, about ¼ inch across, and are narrowed gradually to a very sharp stiff point. They are placed all round the twigs, closely overlapping each other. The long leafy twigs are shed from the older parts of the branches.

Araucaria Cunninghamii, Aiton. Moreton Bay Pine. Queensland and New Guinea.

This is the species which grows into the largest trees in Singapore. It may attain 100 feet in height, and the branches at the base 25 feet across. The trunk is often somewhat curved, and bears whorls of branches usually rather far apart, at intervals of from three to six feet (the lowest are often closer together). The branches spread horizontally from the trunk, and tend to ascend somewhat towards their tips except the lowest ones which may droop a little. The lowest branches are usually the longest, and give the tree a conical shape. The smaller branchlets are numerous and rather irregularly arranged in bunches. The leaves are needle shaped, curved, acute but not spiny, and usually about ¼ inch long; they are closely placed on all sides of the twigs. When young the leaves are pale and covered with a waxy bloom; when old they are dark green.

The above description applies to the variety *glauca*, which is more robust in Singapore than the typical form of the species, of which the young leaves are not pale and waxy; the leaves also are a little longer, more sharply pointed and not so close together, and the whole tree has a more lax habit of growth.

Araucaria excelsa, R. Brown. Norfolk Island Pine. Norfolk Island.

Young plants of this species are often used in pots for indoor decorative purposes in England. In Singapore the trees are not very robust; one old tree in the Gardens has attained about 60 feet; it has a curved trunk. The branches are borne close together, and are very slender and drooping. The twigs lie in two close ranks one on each side of a branch, so that the branch has a flattened appearance, and the young twigs are gradually shorter towards the tip of the branch which thus tapers to a point. The leaves are similar in appearance and arrangement to those of *A. Cunninghami*, but they are smaller (never exceeding ¼ inch) and more slender.

Araucaria Cookii, R. Brown. Cook's Araucaria. New Caledonia and Polynesia.

This is more commonly planted in Singapore than *A. excelsa*, and

forms a more vigorous tree, attaining 100 feet in height. Its trunk is usually curved, sometimes with a definite kink. The branches are close together and stand out almost horizontally with somewhat ascending tips. The leaves are very much like those of *A. excelsa*, but the twigs are borne more irregularly so that the branches are not usually flattened, and the youngest twigs at the tip of each branch form a close bunch which gives the end the appearance of being cut off square instead of the tapering ends to the branches seen in *A. excelsa*.

Podocarpus

This is a large genus of conifers, distributed chiefly in the southern hemisphere, but also extending into eastern Asia. The leaves of most species are flattened, with a distinct midrib, quite unlike the typical needle leaf of pines and firs, but some have small needle leaves; the commonest Malayan species (*P. polystachyus*) is of the former kind, but *P. imbricatus* has needle leaves. The seeds are borne singly, not in cones. The male cones are borne on separate trees.

Podocarpus polystachyus, R. Brown. Sintada. Malaysia.

A bushy tree growing to 30 feet or more, the branches not in whorls, horizontal, ascending towards their ends, and so forming a tree of rather irregular but pleasing shape. The leaves are usually 2½ or 3 inches long and about ¼ inch wide, narrowed gradually to the base, the tip not sharply acute, stiff and leathery in texture, with a prominent midrib but no other veins.

The male cones are 1 to 2 inches long, very slender, and consist of a large number of small yellow scales. The seeds are borne singly on special fleshy stalk-like organs; they are egg shaped, about ¼ inch in diameter, and have a blue-green fleshy covering.

This species naturally grows in the landward side of mangrove swamps, in more or less sandy soil, or even quite on the sea shore (beyond the reach of the tide). It will tolerate the ordinary stiff soil of the Singapore Gardens quite well, but is slow in growth. At least two allied species will grow in Singapore, but the names of these are not precisely determined. One has very large leaves, up to 10 inches long by more than ½ inch wide, and forms a very handsome young tree. The other has smaller leaves, and is probably the Japanese *P. macrophyllus*.

Podocarpus imbricatus, Blume. Southern Asia.

This widely distributed species occurs not uncommonly in mountain forests in Malaya, having been found so low as 200 feet elevation on Gunong Pulai, and tolerates cultivation in Singapore better than any other local conifer except *P. polystachyus*. In the forest it forms a tree with a clean straight trunk, but where it is grown in the open the tree has branches right to the ground level and forms at its best a very regular rounded shape. The finest tree in the Singapore Gardens is about 40 feet in height.

The leaves of *P. imbricatus* are quite unlike those of *P. polystachyus*,

being of the small needle type. They are of two forms, more or less intergrading: (1) about ⅛ inch long, very narrow, laterally flattened, and arranged obliquely more or less regularly in two rows so as to give a flattened appearance to the twigs, and (2) short (1/10 inch) curved acute needle leaves arranged all round the twigs. It appears that the first type of leaves are borne chiefly on twigs in the more shaded positions. The male cones are yellow, slender, and up to ½ inch long when expanded. The seeds are very small, solitary on the ends of short branches.

As remarked above, this tree grows well in Singapore, partly perhaps because it will stand the soil conditions better than Dacrydium. One tree in the Singapore Gardens produces seeds. Young plants prefer light shade until their growth is well established.

Dacrydium

Dacrydium elatum, WALLICH. RU BUKIT. INDO-CHINA THROUGH MALAYSIA TO FIJI.

This species grows naturally in mountain forests from 2,000 feet elevation upwards, usually on ridges; the trees may be 80 feet in height with a trunk 2 feet thick. When grown in the open it forms symmetrical bushy trees; those planted on the hill at Penang (where the species may also be seen growing wild in the forest) are well known. The branches are numerous and rather slender, curving upwards. The bark on the trunk is dark reddish, and forms irregular smooth flakes.

The leaves are decidedly variable in size, even on different parts of the same tree, but they are always of the needle shape and always arranged symmetrically around the twigs and not in two flattened rows as in *Podocarpus imbricatus*. On young plants and on some shaded branches of older trees the leaves are ⅓ to ½ inch long, straight, sharp pointed and very slender. On most of the twigs of older trees the leaves are very short (1/10 long or less) close together and sharp pointed.

The male cones are short, cylindric and yellowish (usually under ¼ inch long). The seeds are small and are borne on special scales at the ends of twigs.

This species does not tolerate Singapore conditions so well as *Podocarpus imbricatus*, and produces few seeds here. The soil conditions are probably in part responsible for the poor growth of specimens in the Singapore Botanic Gardens. At the Waterfall Gardens, on sandy soil, it grows much better and forms shapely bushy trees with dense foliage.

Other Conifers.

A number of species of exotic conifers will flourish at our Malayan hill stations, though as yet there are few mature trees of any of them; much more experiment with new introductions is needed. On Penang Hill it is evident that the Monterey Cypress (*Cupressus macrocarpa*) and other species of Cupressus will grow well, and also *Cryptomeria japonica* and *Pinus Merkusii*; there are probably many others. In the lowlands a more

restricted number of exotic species will grow well; the most important of those at present in cultivation are described in the following paragraphs.

Thuja orientalis, Linn., the Chinese Arbor-vitae, a small tree of cypress habit, grows well in Singapore. It has a symmetrical pyramidal shape, and will grow to at least 20 feet in height. The branchlets are flattened (all the side twigs being in one plane) and these branchlets are arranged in more or less flattened branch-systems in vertical planes all round the tree. The leaves are minute scales, closely pressed to the twigs in opposite pairs, forming four regular rows. I have never seen seeds on this tree in Singapore, but it may be propagated by cuttings. Both this species and the varieties of *Juniperus chinensis* are very useful where small trees of formal shape are required.

Juniperus chinensis, Linn., the Chinese Juniper. This grows into a tall tree in China. In Singapore only rather young plants exist, and it is doubtful whether they will grow into big trees. Apparently there are several varieties of the species cultivated here, but as none of them bears cones it is difficult to be certain of their identity. Trees of the species are said to be typically pyramidal or columnar in shape, and most of the young Singapore trees are pyramidal, though some have a more irregular shape. The leaves are of two forms, which may both occur on the same plant, or a plant may have one form only. The normal leaves are small and scale-like, about 1/16 inch long, closely pressed to the twigs in 4 ranks; on most plants will be found occasional stiff sharp spreading needle-leaves 1/5 inch or more long. Some varieties have only the spreading needle-leaves. The two varieties most cultivated at present are one of a regularly pyramidal shape with only needle-leaves, and one of somewhat irregular outline which has normally only the small scale-leaves, and the smaller twigs densely bunched together. This second variety grows well and is very ornamental. All are propagated by cuttings.

Juniperus conferta, Parl., is a Japanese species which grows very well at the Singapore Gardens. It has a prostrate habit, creeping along the ground, and is very effective in the sun rockery. None of the junipers produce seeds in Singapore, but they may be propagated by cuttings.

Cupressus funebris, Endl., the Chinese Weeping Cypress. This species in China attains 70 feet in height; here it forms a small spreading tree, characterised by the drooping branchlets which hang down vertically below the main branches. These branchlets may be a foot or more in length, and are flattened, having small side twigs more or less symmetrically arranged. The leaves are small and scale-like, four-ranked, and pressed closely to the twigs. This is evidently a tree of slow growth. It has not the formal shape of Thuja and the Chinese junipers, and is not so well suited to general gardening use.

Other species of Cupressus. Recently seeds of *C. macrocarpa* and *C. lusitanica* var. *Benthamii* (also known as *C. Knightiana*) have been obtained

from Ceylon, and the plants have grown remarkably well in Singapore. It is too early yet to say what size they may attain. There appear to be intermediates between the two species, due perhaps to natural cross-pollination between the parent trees in Ceylon. Both *C. macrocarpa* and *C. Knightiana* are hardy in England. The Japanese *C. pisifera* v. *squarrosa* with rather long soft leaves, has also lately been cultivated as a pot plant by local Chinese gardeners.

ROADSIDE TREES

BY

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The question of the treatment of roadside trees has become a matter of some importance during the last few years, owing to the advent of more specialised treatment in regard to town-planning generally. Some four years ago, the writer, in his capacity as Adviser on Roadside Trees, etc., to the Penang Municipality, decided to write up certain aspects of the subject in order that the roadside tree staff should work on definite lines in dealing with the large number of roadside trees in Penang. Papers dealing with planting and pruning were prepared and have been of considerable value in dealing with the problem. As roadside tree planting and pruning have become important matters for the various Municipalities, Sanitary Boards, and Rural Boards in Malaya, it is felt that the papers might very well be published in the hope that they may be of use to these bodies. Accordingly, the writer has revised the papers and presents them herewith.

1. Planting.

1. PREPARATION OF HOLES.

Position.—This must be considered very carefully. Various points arise in this connection, amongst the most important being (i) possible future improvements, such as widening of roads, rounding of corners, etc., in which case the trees should be placed, if possible, in the positions they will occupy after such improvements have been carried out, (ii) the proximity of pipes, cables, etc., in which case the trees should be planted as far away from them as possible and species with compact root systems be chosen.

Size and Shape.—The holes should be cut square i.e. about 4 feet each way. This facilitates digging as it gives plenty of room for working and, in addition, provides more root space for the young tree.

Depth.—This must necessarily vary, but should never be less than 2 feet 6 inches save in exceptional cases where there are good reasons why holes of this depth should not be dug, for example, in swampy land, in land having a relatively high water table or where the question of adjacent pipes or cables has to be considered.

Drainage.—In places where natural drainage is good this need not be considered. However, in most towns and in many country places, it will be found necessary to provide drainage owing to the low lying nature of the country and the abundant rainfall experienced. Where supplied, 6 inches or 1 foot of drainage is necessary, according to the depth of the holes. It should consist of broken bricks, clinkers, stones, etc., and be placed in the bottom of the holes.

Manuring.—A good supply of cow manure should be well mixed with the soil. Failing this, a good complete fertilizer of a slow-acting

type may be used according to the type of soil; it should be used under the directions of the firm supplying it. Where the soil is very poor, it should be improved by incorporating some better soil in addition to the manure.

Final Preparation.—Fill the hole with the compost and raise above the level of the surrounding surface. Turf in a circle, leaving a bare circle of about 3 feet in diameter. Leave for about a week to allow the soil to sink and become firm before planting.

Note.—As far as possible the young plant should be planted in a pocket of soil only, the manure in the initial stage being kept away from its roots. This is for two reasons, *viz*:—(i) cow manure often attracts white ants and if the roots of the young plant should be damaged in planting, this will give the white ants a means of entry into the tissues of the plant (ii) the proximity of rich plant food will induce vigorous root growth and the plant will soon take advantage of the manure supply.

2. PLANTING.

Position.—Set the young plant in the exact centre of the circle.

Planting.—Make a hole with a garden trowel if the plant is small, with a changkol if the plant is large. This hole should be sufficiently large to accommodate the plant comfortably. Set just right, not too high nor too low and make firm the soil around the plant. If the plant has plenty of roots spread them out and gently shake the plant so that the soil used in filling will settle amongst the roots in a more or less natural manner.

Watering.—All newly planted trees should be watered immediately after planting.

Staking.—A straight stake about 5 feet in length should be put to all newly planted trees. This stake should be driven about 2 feet into the ground and must be upright; this allows for 3 feet above ground for tying purposes.

Remove all but the main stem of the plant and tie the latter to the stake. Ties should be neither too tight nor too loose and should be frequently inspected to ensure that they do not become too tight. Tarred string or twine should be used for the purpose. On no account should wire be used.

Protection.—Guards of some sort must be provided to protect the plants from damage. In the early stages, a simple arrangement is a wire netting cage about 6 feet in height and about 3 feet square. When the plants have made good growth and are becoming small trees, this can be removed. . It is seldom necessary to give them further protection, but where cattle are allowed to graze on the side tables, it is a good plan to put a spiral of barbed wire around three stakes driven into the ground near to the young trees; this prevents the cattle from tearing off the young bark.

Time to plant.—Planting should be carried out preferably during showery weather, but routine watering should be resorted to when necessary. However, as a general rule it may be stated that planting should not be done either during a drought or during a very rainy period such as is experienced during the rainy season.

3. AFTER TREATMENT—1ST STAGE. (up to 4 feet in height).

Watering.—Plants should be watered whenever the need arises. This will mean daily watering in the early stages unless there are frequent rains.

Pruning.—Plants must be kept to a single stem only. All side shoots should be cut off near to the main shoot.

Staking.—The young plant should be tied to the stake as it grows and be trained into a straight main stem.

Cultivation.—Stir up the top soil around the plant occasionally, to aerate the soil and keep free of weeds.

4. AFTER TREATMENT—2ND STAGE. (up to 7 feet in height).

Watering.—This will be required during dry periods, otherwise the ordinary rainfall will be sufficient.

Pruning.—Maintain the single stem, removing all side shoots. Should the top of the main stem be damaged, cut back to the first bud below the damaged part. The resulting shoot will then take the lead.

Staking.—When the plant has reached 4 to 5 feet in height, replace the original stake by a strong stake about 8 feet in length and 2 to 3 inches in diameter. Point one end and drive it into the ground vertically, close to the base of the young tree. Tie the young tree to the new stake and train it up to 7 feet in height. The stakes will need to be 2 feet in the ground, thus allowing 6 feet above the ground.

5. AFTER TREATMENT—3RD STAGE.

First Branching.—At approximately 7 feet the top of the shoot should be removed to induce the plant to branch. Only three to five shoots should be allowed to develop, the remainder being removed.

Second Branching.—When the branches have made good growth they should be cut back to about 3 feet to induce each of them to branch. This will give a foundation on which to build up the tree.

6. LATER PRUNING.

Further work on the tree will consist of occasional pruning to keep it down to proportions which can be dealt with easily.

The aim should be to produce a well balanced tree, which will never grow to unwieldy proportions nor, by becoming unbalanced, be a source of danger to road traffic.

7. LATER MANURING.

Once or twice a year the plants should receive a dressing of manure, until they have reached proportions where such a supply is unnecessary. The length of time manuring would have to be carried out must vary

according to the species and according to the degree of growth made by the individual tree. Slow growth should be accelerated by dressings of manure, whereas extra rapid growth should be retarded by with-holding the manure supply. By this means the trees can be made to grow uniformly where there is a long line of them. Intelligent manuring is required to produce this result.

General Observation.

The above are general rules for guidance in producing new roadside trees. Variations in species and in conditions of situation, may necessitate slight modifications; especially is this so in regard to early pruning. This matter is dealt with under paper *" II. Pruning " where the individual requirements of the species generally used for roadside tree work are discussed.

(To be continued)

* To be published in the next number of this magazine.

THE AVOCADO PEAR*

BY

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The Avocado Pear is a comparatively recent introduction to horticulture although it has been cultivated in Mexico and Central America from very early times. In these countries the fruit is cultivated around dwellings, no large plantations exist and very little care has been taken with its cultivation (1). During the last thirty years or so, horticulturists in California and Florida have devoted attention to its cultivation and the vegetative propagation of superior varieties. In these two States the cultivation of the Avocado has become of commercial importance. It is also cultivated largely in the West Indies and Hawaii.

The commercial aspect of Avocado culture has been especially emphasised since 1910 (2) when explorers from the United States of America were sent to Mexico and Guatemala to obtain the best varieties cultivated in those regions. The California Avocado Association, which was organised in 1915, has influenced the development of the industry (2) and its committee has rendered valuable service by the registration and classification of varieties. The Year Book of this Association for 1931 contains a list of 400 varieties including names of Avocados published in the West Indies and Hawaii (3).

A co-operative marketing agency, founded by the Calavo Growers of California, in 1924, assists with the marketing of the fruit, and a similar organisation exists in Hawaii, shipping the fruits to American markets (7).

The Avocado is now cultivated in most tropical and sub-tropical countries although it has not yet become as popular elsewhere as it is in America.

The date of the introduction of the Avocado into Malaya is uncertain, but Ridley (4) mentions that trees were fruiting in Singapore in 1902. The Avocado was also being cultivated at the Government Experimental Plantation, Kuala Lumpur in 1908 (5). A few of these trees fruited in 1913 and, early in 1914, the present writer (6) advocated extending the cultivation of the fruit. Since that date the Avocado has been grown on a small scale in different parts of the Peninsula and has fruited well both in the plains and at the " Gap " 2,800 feet above sea-level. During the last decade, seedlings have been distributed by the Department of Agriculture; in spite of this fact, the fruit is not as widely known, even among Europeans, as it deserves to be. This is probably due to the fact that a taste for the fruit has to be aquired, in consequence of which it is rarely seen in the local markets.

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Botanical.

The Avocado Pear belongs to the Natural Order Lauraceae and is therefore related to the Cinnamon. The varieties under cultivation are of two species, viz. *Persea gratissima*, Guertn (syn. *P. americana*, Mill) and *P. drymifolia*, Cham. and Schlecht (syn. *P. americana* var. *drymifolia*, Mez.) The former species include the West Indian and Guatemalan types or races and the latter the Mexican types (1).

It is a tree of medium size, attaining a height of 20 to 30 feet under cultivation, but in Central America it is recorded that old trees reach a height of 60 feet (1).

The tree may be either erect, compact, or spreading in habit. The bark of the trunk and older parts of the branches are grey in colour while the tips are smooth and green. The leaves are alternate, crowded near the ends of the branches and vary in shape from lanceolate to ovate or even obovate with blunt to acuminate tips. The blades of the leaves vary from 3 to 4 inches to as much as a foot in length, light dark green in colour, smooth and shining above and glaucous beneath. The flowers are small, yellowish-green in colour, complete with both stamens and pistils, and they are borne in racemes near the ends of the branches.

Stout's (9 and 15) investigations on the Avocado have enabled him to classify varieties into two groups (1) those (Group A) in which the flowers function as pistilates or females in the forenoon and staminates in the afternoon and (2) those (Group B) which function as males in the forenoon and females in the afternoon. The flowers open synchronously in sets and there are normally two periods of opening. In Group A the first period of opening takes place in the forenoon when the stigmas are receptive. These flowers close at about midday and open again for the shedding of pollen in the afternoon of the following day. In Group B the flowers open for the first or female phase in the afternoon, close in the evening, opening again for shedding pollen on the following morning or on the morning of the third day. There is a certain amount of overlapping as regards opening and closing of flowers, especially under unfavourable weather conditions when the first and second openings of the flowers are often delayed. Some varieties have been found to produce excellent crops of fruits in the absence of trees of another group, but despite these observed instances in which trees are not dependent upon cross-pollination, Stout considers that interplanting of reciprocating varieties is normally advisable to ensure that proper pollination takes place which is essential to the production of fruit.

Varieties.

The varieties of both species of Avocado are closely alike in many respects; the differences between the different races are briefly as follows (1):—

1. Leaves anise-scented, skin of fruit thin and membranous (rarely more than 1/32 inch thick)—*Persea drymifolia*. The Mexican race.

2. Leaves not anise-scented, skin of fruit thicker (from 1/32 to 1/4 inch in thickness)—*Persea gratissima*:

(*a*) Fruit ripe in summer, skin usually not more than 1/16 inch thick, leathery in texture—West Indian Race.

(*b*) Fruit ripening in winter and spring, skin 1/16 to 1/4 inch thick, woody in texture—Guatemalan Race.

The Mexican race is a native of the Mexican highlands and will therefore withstand cold conditions.

The West Indian race has been developed in the tropical lowlands of Guatemala, while the Guatemalan race is a product of the highlands, but there are intermediate forms.

Other distinguishing characters are that the flower of *P. drymifolia* is more pubescent and the underside of the leaf more glabrous than that of *P. gratissima*. The fruits of both species vary in size, but those of *P. drymifolia* are usually smaller than those of *P. gratissima*. They vary in size from a few ounces to three pounds; in shape from round to oval and pear-shaped, and in colour from green to purplish-black. The fruit is a drupe having a single large seed, often 2 inches in diameter, in the centre. The edible portion of the fruit is between the skin and the seed, and when ripe is of the consistency of butter, cream-coloured to green near the skin, of a nutty flavour and contains a large percentage of fat.

The varieties cultivated in Malaya vary considerably in size, shape, and also colour of the fruit, but the majority belong to the West Indian race. The Mexican type is little known, but a few seedling trees are growing at the Central Experiment Station, Serdang, although they have not yet fruited. In Malaya, the West Indian varieties are suitable for cultivation from sea-level up to an elevation of about 3,000 feet. The Guatemalan varieties are said to withstand both cold and heat, also a dry climate, while the Mexican varieties are said to withstand a few degrees of frost. These two races may thrive at higher elevations in this country.

In selecting varieties for cultivation, preference should be given to those with fruits of medium size, say 12 to 16 ounces. The fruit should be of good flavour, the skin tough, leathery and of moderate thickness, so that they will withstand transport for some distance. The seeds should be small and not loose in the cavity otherwise the flesh may be injured in transit.

Propagation.

Propagation locally has been by seed, but the disadvantage of this method is that the offspring cannot be relied upon to come true to the parent type; the Avocado is therefore usually propagated by budding or grafting.

Attempts have been made to propagate the Avocado by marcottage but so far without success, although it is reported that, after numerous failures, well-rooted plants have been obtained by this method in the Philippines (10).

By planting seedlings in beds and laying them down for propagation by the etiolated shoot method, rooted shoots have been obtained, but so far the difficulty in obtaining authentic planting material has made this method impracticable. A stock of budded material is, however, being raised by this Department and will be available in the rear future, when budded plants of known origin have been established by the etiolation method may prove useful for rapidly increasing supplies of reliable planting material.

The most common method of propagation is by budding and grafting, and the best stocks to use for this purpose in Malaya are seedlings of our local varieties. In California, the Guatemalan race has been budded on to stocks of the Mexican race with the object of giving hardiness to the former, but in the even climate of the plains of Malaya hardiness is a point of little if any importance.

Raising Stocks.—The seeds should be planted as soon as possible after removal from the fruit. They should be planted pointed end upwards in loose sandy soil, in boxes or seed beds and after germination the seedlings should be transplanted into large bamboo pots or into nursery beds at about 18 inches apart. Germination takes place in a short time and seedlings are ready to bud in six to eight months, when the stems will be about one half inch in diameter. It is essential that seedlings to be used as stocks should be maintained in vigorous growth.

Budding Methods.—Several methods of budding Avocados are recommended and have been successful in other countries. It should be borne in mind, however, that skill and patience are required, and above all a very sharp budding knife. For the benefit of those who do not understand the various methods of budding, they are described briefly as follows:—

The "inverted T" method is performed by making a "T" shaped incision in the bark of the stock an inch or two from the ground with the blade of a sharp knife. Budwood is then procured from a shoot of recent growth not soft enough to snap when bent but beginning to mature. The buds should be plump but not bursting into growth. The knife should then be inserted about an inch below the bud and drawn upwards and inwards beneath the bud, bringing it out about the same distance above the bud. A shield-shaped piece of bark with a section of wood attached is then obtained. The section of wood should be carefully removed and the bud attached to the piece of bark inserted into the incision in the stock. The bud is then bound firmly in place with raffia or a thin strip of waxed cloth, taking care not to cover the bud completely. In about three weeks from the time of budding the tying material should be removed and if, on examination, the bud is found to be green it should be retied but not tightly, and at the same time the apex of the stock should be pinched out. The bud should be examined again at the end of six weeks and if it is still alive the wrapping may be removed. At the same time the stock may be cut back still further, but some leaves should be left. The stock should not be cut back completely

until the bud shoot is about 2 feet in length. When cutting back the stock, a neat cut should be made close to the union between bud-shoot and scion and the wound should be covered with some protective material such as grafting wax.

Other methods of budding recommended differ only in the shape of the incision in the stock. The Forkert method, a modified form of rectangular patch budding, has been used successfully in Java (12) with buds from non-petioled ripe budwood. The method consists in making three incisions in the stock, two parallel downwards and one across the top, forming three sides of a rectangle. The bark is then raised carefully, gripped between the blade of the knife and the thumb and stripped downwards. Three quarters of the flap of bark is then cut away. A piece of bark of the same size and shape as the incision in the stock containing a bud is then inserted and tied into place. The subsequent procedure is the same as for the inverted "T" method.

Grafting.—In Florida (1) the Avocado has been propagated by grafting the tips of young shoots on to the shoots of young seedlings by a modified method of side-grafting. The operation is performed as follows:—The seeds are germinated in boxes and, when the young shoots are 5 to 6 inches in length, the seedlings are taken from the box and laid on a bench. A cut one inch long is made in the side of the shoot just above the seed and a thin section is removed. The scion is taken from the tip of a small branchlet not fully mature and about one inch long with two axillary buds in addition to the terminal one. The scion is then tapered on one side to fit the cut on the stock and is bound into place. The plant is afterwards potted, placed under partial shade and carefully watered from day to day. After union is effected the top of the seedling is removed and the scion allowed to grow.

Cleft Grafting.—Cleft grafting is used on young stocks and in top working older trees. For grafting on to young stocks the scion should be a partially mature shoot, greenish to light brown in colour and about 4 to 5 inches long. This should be tapered at the lower end and inserted in a cleft in the top of a stock of the same colour and size as the scion (10).

Top Grafting.—This method is used in cases where a tree has proved to be unfruitful or is of an inferior variety. The trunk is cut back with a saw to within three feet of the ground. The trunk is then split, a saw being used to cut down for several inches when a soft wood wedge is inserted and driven in until the trunk commences to split; the edges of the cleft are then smoothed with a knife. Scions of mature growth are then cut and tapered to fit the cleft, one on each side of the trunk, so that the cambiums of both stock and scion are in contact. The wedge is then lifted sufficiently to allow enough pressure from the cleft in the stock to hold the scion in place, after which the wedge is cut off flush with the top of the stock. The cleft and sides of the stock are then covered with grafting wax to prevent the entrance of water. To prevent sun-scorch the top of

the stock end and the scion are covered with a tough paper bag, holes being made to allow new growth from the scion to elongate. Another method is to place a paper collar round the top of the stock and fill it with sand, holes being made in the base to allow drainage of rain water. The sand should be placed round the outside of the scion as well as at the top of the stock. These paper coverings should not be removed until the scion is large enough to provide shade. A certain number of shoots from the stock may be allowed to grow to maintain circulation of sap which assists healing. They should be eliminated as soon as the scion and stock have properly united.

Another method of top working old trees is to cut back a certain number of branches leaving one or two as "lungs" to maintain the circulation of sap. The young shoots, which sprout from the cut branches, should be limited to two or three; when large enough, they are budded in the same manner as seedling stocks.

Soils and Cultivation.

Soils.—The Avocado is said to thrive on a wide range of soils in South America. It grows excellently on both sandy soils in Florida and heavy clays in California, but it is essential that the soils should be well drained. In Malaya it has been grown successfully on both quartzite hill and quartzite valley soils, also in the granite soils of the hills.

Planting.—The distance at which to plant will depend upon whether the soil is particularly fertile or rather poor, also on whether the tree is a seedling or has been propagated vegetatively by budding or grafting. Planting distances recommended are 20 ft. x 20 ft., which allows 108 trees per acre, to 26 ft. x 26 ft. or 64 trees per acre. On light sandy soils or with budded plants 20 ft. x 20 ft. is usually sufficient, but seedlings on rich soil may be given the wider spacing.

When planting it is advisable to make large holes, and these should be filled with good top soil and cattle manure or garden refuse. Usually holes 2 ft. x 2 ft. x 2 ft. should be dug and when filling them the soil should be made quite firm.

The Avocado is rather sensitive to disturbance of the roots; plants should therefore be raised in bamboo pots, so that they can be transplanted with the roots intact. If raised in nursery beds the plants should be prepared for transplanting by balling a week or two before this operation takes place. Should the roots be at all disturbed the foliage should be reduced or evaporation will be too rapid and the plants will receive a severe check.

The best time to plant is during the rainy seasons of the year; even at this time a good watering should be given to settle the soil round the roots and the plants shaded until they are established.

After-cultivation consists in keeping the soil round the plants free from weeds and, as the trees develop, the area weeded should be extended. A mulch of weeds and cattle manure is beneficial to the growth of the plant. The Avocado requires good cultivation and manuring to give the

best results. Cattle manure, if obtainable, is best for general purposes. The growing of leguminous green crops and turning them into the soil periodically will help considerably towards keeping the soil fertile. In addition, fertilizers are recommended (1) in the form of bone meal, and cotton seed or groundnut cake at the rate of 4 or 5 lbs. per tree added to the soil after the trees have borne fruit, and again after the fruit is set. Little is known about the manuring of the Avocado in Malaya, but in addition to cattle manure a mixture of basic slag, calcium cyanamide and sulphate of potash in the proportion by weight of 3: 1: 1: may be applied twice a year round the trees at the rate of from 1 to 4 lbs. per tree according to age. If the trees appear to be growing vigorously, the calcium cyanamide may be omitted.

Pruning.—Very little pruning is necessary beyond that which is essential to keep the tree in shape, and the cutting out of dead or diseased branches.

Pest and Diseases.

In Malaya the Avocado Pear has so far been remarkably free from pests and diseases. In America, thrips, *Heliothrips rubrocinctus* and *H. haemarrhoidalis* have caused damage to the foliage, but spraying with nicotine solution has been an effective control. The red spider, *Tetranychus mytilaspidis* has also done damage but lime sulphur mixture has been used successfully in combatting this pest. Attacks by scale insects are also reported from America.

A root disease, *Sphaerostilbi repens*, has caused the death of several trees at the Central Experiment Station, Serdang, and a certain amount of die-back of branches has been noticed.

The Crop.

The Avocado tree, when raised from seed, commences to bear fruit in about the fifth or sixth year from planting, but budded trees are reported to bear fruit much earlier, in some cases, three years after planting. Seedlings planted at the Central Experiment Station, Serdang, in October, 1927 fruited in August and September, 1932. Others planted in April, 1928 fruited in August and September, 1933, while one tree planted in September, 1929 fruited in September, 1933.

Mature trees will bear from a few fruits up to several hundred. Large trees, in their country of origin, are said to bear from 1,000 to 3,000 fruits from 6 to 18 ounces each in weight. Trees bearing larger fruits bear less, the average, however, is said to be 200 to 300 fruits of 12 to 14 ounces each in weight.

Seedling trees vary considerably in their capacity for bearing fruit, they are also said to be irregular in bearing, for a tree bearing a good crop one year may not fruit the next. This is the case at the Central Experiment Station, Serdang, where only about 50 per cent. of the trees have borne fruit in 1933 and of these about half have borne an average crop, others a

few fruits only. The fruits from different trees varied in size from 3 to 4 ounces up to 14 or 16 ounces; in colour from green to purple; the skins of the fruits of some trees were quite smooth while others were rough. None of the trees bore very large fruits compared with varieties under cultivation in the countries of origin, California and Florida, where it is reported that varieties bear fruits up to 3 lbs. in weight.

The Avocado Pear at Serdang commences to flower about the middle of January and the fruits ripen in August and September. There is some difficulty in judging when some varieties are ripe, especially those with green skins. With the purple varieties there is not so much difficulty, for the fruits are green until they commence to ripen, when the colour gradually changes to a purple tinge. The fruits should be picked before they commence to soften, more especially if they are to be transported some distance to a market. Fruits picked when too under-ripe may shrivel slightly, but if picked when nearing maturity they may be stored until they soften.

Methods of Preparation for Food.

In its country of origin (8) the Avocado Pear forms an important article of diet to the population who use it daily throughout more than half the year. An Avocado and a few small corn cakes made from coarsely ground maize is considered, by the Indians of Guatemala, to constitute a good meal. The fruit is broken in half and the pulp, sprinkled with salt, is scooped out of the skin either with the figures or a piece of corn cake. Among the Guatemalans of European blood, the pulp of the Avocado is usually added to meat soups at the time of serving and the flavour imparted is said to be exceedingly pleasant. Another usual practice is to serve a salad composed of thoroughly mashed Avocado pulp, vinegar, salt, pepper and finely chopped onions. This is said to be a popular and very tasty dish though not especially attractive in appearance.

In the United States of America, where the fruit is increasing in popularity, the pulp is used as a salad either alone or mixed with lettuce leaves, onions or other vegetables. Sliced or mashed it can be made into sandwiches with bread or cracker biscuits. It is excellent as a salad, either with cold meat or with bread and butter, when mashed and mixed with pepper, salt, and vinegar. Mashed with onions and lime juice it constitutes a favourite dish in Cuba. In Brazil it is looked upon more as a dessert fruit and is also made into ice-cream. The pulp of the fruit, mixed with a little sugar and sherry, has a pleasant nutty flavour and in this way can be used as a dessert.

Food Value.

The flesh of the Avocado is a nourishing article of food containing a high percentage of mineral matter, protein and fat. Its chief value as a food is its high fat content, the digestibility of which has been found by experiment to be equal to that of butter fat or of beef fat.

The calorific energy producing value of 28 varieties of Avocado examined at the University of California represents 1,000 calories for one pound of flesh. The maximum and minimum were 1,325 and 597 respectively. The maximum corresponds to 75 per cent. of the calorific value of cereals and is nearly twice that of lean meat.

The following table from Popeno's Manual of Tropical and Sub-Tropical Fruits represents the work of Jaffa of the University of California on the food value of the Avocado:—

Variety.	Water per cent.	Protein, per cent.	Fat per cent.	Carbo-hydrates, per cent.	Ash per cent.
Trap (West Indian) ...	78.66	1.61	9 80	9.08	0.85
Sharpless (Guatemalan) ...	71.21	1.70	20.54	5 43	1.12
Puebla (Mexican) ...	63.32	1.80	26.68	6.64	1.56
Fuerte (Hybrid) ...	69.86	1 25	29.14	7.40	1.35

Recent investigations by Le Roy Weatherley and Eugene W. Waterman of the University of California (14) using Albino rats as indicators, has demonstrated the presence of Vitamin "B" in the flesh of the fruit. The flesh or pulp was compared with Flesschmanns dry yeast standard and was found to have approximately one-twelfth the value of dried yeast. The authors comment as follows:—"From these investigations it is apparent that the Avocado ranks high as a source of Vitamin "B". If what is known as Vitamin "B" is in reality two vitamin factors one antineuritic and one growth promoting, as recent investigations seem to indicate, it is evident that the Avocado contains both factors since it prevents paralytic symptoms."

Summary.

1. The distribution, botanical, and distinguishing features of the different races of Avocado are discussed.

2. The different methods of propagation of the Avocado are given together with notes on its cultivation.

3. The methods of preparation, food value, and vitamin value of the Avocado are given.

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Miscellaneous.

Mort Aux Moustiques.

THREE MILLION INSECTS PER HOUR.

Remarkable results are claimed for an apparatus invented by a Miss Germaine Gourdon for exterminating mosquitoes and other winged insect pests. It appears to be based on electric light waves, and suction. Experiments with it have been made successfully at Saintes Maries de la Mer in the Camargue, France, which has been described as a mosquito's paradise.

M. Jean Castellano in the *Petit Marseillais* states that experiments with the apparatus, which were controlled by Professor Seguy of the French Natural History Museum, proved so conclusive from the start that the Consul-General of Bouches du Rhone at once asked that three sets of the equipment might be placed in operation in the Camargue.

Since August, 1932, writes Mr. Castellano, Miss Gourdon, as a result of constant experience and daily observations, has made such "stupefying progress" that the "*Capteur de Moustiques*" as he calls the apparatus, seems to date to be an invention calculated to render an immense service not only from a utilitarian point of view—that is to say the protection of crops—but also from that of hygiene by the destruction of masses of insects harmful to man and animals.

Similar apparatus are now being used in the Department des Bouches du Rhone, and also in Italy, Siam, Annam, Florida, and even in Paris, on the terrace of the Ritz, and in the park of the Casino at Enghien.

At a recent demonstration of the apparatus representatives from Mauritius, Reunion, Madagascar and Algiers were present. At nightfall, a small model was put in action on the terrace of the Hotel de la Plage. "It will operate until 3 a.m., by which time," wrote Mr. Castellano at an early hour, "the exhauster will have heaped up in the net placed under the burner more than 900 grams of insects, representing about 4,000,000 victims, of which two-thirds are mosquitoes."

"At the same time a much more powerful plant designed for parks and cultivated areas is performing the same role of destruction in the court of the gendarmerie with the strength of its burner and its powerful exhauster. There, an average of 1,000,000 of mosquitoes are being engulfed hourly."

M. Castellano then describes the scene. "As far as the rays emanating from the mercury vapour lamp, made of melted quartz, you see massed waves of insects of every kind, including mosquitoes. Within this zone you see them irresistibly precipitating themselves towards the burner, where they disappear, swallowed up by the mouth of the exhauster." Blinded by the strange light, they trace in the air against the screen of the night most fantastic designs in blue-like silver wires carried on the wind."

Miss Germaine Gourdon and her father declare that it will be possible to adjust the wave lengths to attract different insects, and that it should be possible to prepare a table of the wave lengths required.

Even a comparatively small portable plant has a range of 500 metres, and another type is available for trapping mosquitoes in and round about residences. Two of these "*Capteurs de Moustiques*" are being sent out to Mauritius with a trained expert to superintend them and tune them up on the spot. (Reprinted from the West India Committee Circular, Vol. XLVIII, No. 913, September, 1933).

Resolution by The Malaria Advisory Board, F.M.S., August, 1934.

The Malaria Advisory Board, F.M.S., invites the attention of all concerned with anti-malarial work to the vital importance of maintaining in a state of efficiency all drainage, anti-malarial oiling etc: especially in view of a probable influx of labour and its frequent movement throughout Malaya. Economies in anti-malarial work should be reviewed and used only with great caution; they must entail increased supervision and should not be used unless there is both careful control of the application of the method and efficient checking of the results by means of adequate larval surveys. The Board also desires to draw attention to the vital importance of undertaking thorough anti-malarial measures for at least three weeks prior to the re-opening of all labour "lines" which have been closed down.

THE BOOKWORM VANQUISHED*.

There is a war going on; a war so insidious that most of the inhabitants of this planet are unaware of it, yet of so vital a character that its effects upon posterity may be considered of far greater importance than those of the politico-economic wars that feature in the daily news. It is a war of extermination, against the common enemy of mankind, the *Sitodrepa panicea*, as it is called in the United States. This is none other than the despised bookworm of the insect, as opposed to the human, variety. The fight to save the literary and artistic treasures of past ages from the destructive activity of these pests has been carried forward for centuries against tremendous odds. The ordinary ravages of time, through climatic conditions, wind and weather, fire and flood, have been mild as compared with the damage created by the lowly worm. The propagation of the species has been so rapid and difficult to check that until only recently librarians have been throwing up their hands in despair. Under favourable conditions the *Sitodrepa manicea*, known also as the "drugstore beetle" (which is capable of eating arsenic and lead—in fact, anything except cast iron) will develop from an egg within the short space of two months. Four generations within a year are not unusual, and Houlbert, in his "Les insectes ennemis des livres" (Paris 1903), gives these interesting statistics: "Each female lays about sixty eggs. The following numbers represent the offspring of a single female at the end of a year, presuming that half of each generation is composed of females: first generation, 30; second generation, 900; third generation 27,000, and the fourth generation, 810,000."

It seems odd that, although the vandalism of these pests has continued for centuries, as lately as 1928 no effective remedy had been found. In that year, however, the staff of the Huntington Library at San Marino, Cal., alarmed over the discovery of damage done to some 200 volumes, bestirred themselves and enlisted the aid of the California Institute of Technology. From that time forward the campaign entered a new phase and the warfare became scientific. How thorough were the pains taken with the library's possessions, and how comprehensive the research and experimentation which brought ultimate victory to the crusaders, is revealed in the interesting monograph, "Preservation of Rare Books and Manuscripts in the Huntington Library", by Thomas M. Iiams, reprinted for private circulation from *The Library Quarterly* for October, 1932. Here is part of his story: "By November, 1928, the Huntington Library realized it was fighting a losing battle in using methods advocated by other institutions. At that time we were examining all suspected volumes carefully, dusting and brushing inside the covers as well as the pages, then subjecting the books to a three or four

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* **Brooks, Phillip. The New York Times Book Review. January 22, 1933 and reprinted from *The Philippine Agriculturist*, Vol. XXIII, No. 3, August 1934.**

day's treatment of Oronite light solvent in an airtight metal case, and finally sprinkling them throughout with camphor powder and shelving them apart from the main files in a "convalescing ward", as it were, to be inspected from time to time for new signs of infestation. In May, 1929, a new generation of beetles made their way into other volumes, and the vicious cycle began all over again".

The solution of the problem consists in vacuum fumigation, by which means almost perfect penetration is obtained without opening every book. The ideal fumigant evolved is a combination of ethylene oxide and carbon dioxide in a liquid that is neither inflammable nor explosive. This fumigant appears on the market now under the trade name "Carboxide". With the aid of Dr. Irving Gleason, a chemical engineer, there was designed a fumigator five feet in diameter by ten feet long, large enough to accommodate five or six library trucks full of books at one time, or even large pieces of furniture, tapestries and other art objects. The actual operation of the machine is so simple that it does not require the services of a skilled engineer or a fumigating expert. Since the apparatus was installed, all suspected volumes in the rarebook stack have been fumigated, besides any foreign shipments that showed the least signs of infestation. Of course, until the work of fumigating all the books has been completed there is always the possibility of re-infestation, but with the strict vigilance that is being observed it is believed that the battle has been won, and, as far as the Huntington Library is concerned, in the words of Mr. Iiams, it is to be hoped that the " 'diet of worms' will once again be the good earth rather than priceless volumes".

But there is still another phase in the campaign for the preservation of rare books and manuscripts, and that is the struggle against the effects of climate. In *Bureau of Standards Miscellaneous Publications*, No. 128 (October, 1931), it was reported that "no library was able to control completely the variation of temperature and relative humidity within the narrow limits considered necessary for successful preservation of records, and none attempted to minimize acidic pollutions of the air". But the Huntington Library had already made considerable progress in this direction also. Among the destructive agents light, but particularly sunlight, was found to be the cause of "yellowing" and brittling. To correct these evil effects extensive experiments were carrid out to determine the calibre of the rays penetrating into the various rooms from both natural and artificial light, and an investigation was made of the advantages of different types of window glass and electric lamps. The result was the installation of actinic glass in the windows on one side of the new reference room and the blocking of those in the main exhibition room. Then there was the problem of dust and acids from the air entering the stacks, and this was successfully solved by means of an air-conditioning plant. In the matter of variations in temperature and humidity, the library has been maintaining for about

two years what is now regarded scientifically as ideal conditions, namely a temperature of 70 degrees Fahrenheit and a relative humidity of 50 per cent. Vellum manuscripts that curled and cracked when the humidity was low can now be handled with the comfortable assurance that the gold illuminations will not peel off.

For covers of books the following preservative has been found a satisfactory protection against cockroaches and other insects that eat bindings, evidently for the starch or glue. If put on carefully this preservative does not change the appearance of book covers.

Formula:

Corrosive sublimate	1 ounce.
Pure phenol (carbolic acid) ..	1 ,,
Methylated spirits or good alcohol ..	1 pint.
Liquid shellac	1 ounce.

Directions:

With a clean cloth dampened with the preservative rub the binding of books lightly. Do not rub over the lettering; just pat with the cloth.

Reviews.

Tomatoes: Cultivation, Diseases and Pests.

By W. F. Bewley, D.Sc., 71 pp. Bulletin No. 77, Ministry of Agriculture and Fisheries, London: His Majesty's Stationery Office Adastral House, Kingsway, W.C. 2, 1934. Price 1s. 6d.

The growing importance of the tomato industry at home will be realised when it is pointed out that the production of tomatoes in Great Britain under glass is estimated at over 1,140,000 cwts. per annum. This, however, only amounts to about one third of the total home consumption, since the imports from other countries during 1932 were no less than 2,442,000 cwts. It is estimated that there are roughly 3,350 acres of commercial glasshouses in Great Britain and probably 2,000 acres are devoted solely to the cultivation of tomatoes.

With the considerable increase in the home production during recent years the Cheshunt Research Station has made a scientific study of tomato growing and much of the knowledge which has been attained after years of research is now made available to growers by the author, who is the Director of the Station.

Attention is drawn to the value of the tomato as an article of food, since it not only contains valuable mineral salts, but is particularly important as a source of vitamins. Further, whereas vitamins in most vegetables and fruits are adversely affected by cooking, those contained in the tomato remain practically unchanged. The nutritional value of the tomato has been definitely proved in practical tests conducted by experts and its popularity does not depend on theories based on mere chemical analyses of the fruit.

The bulletin deals comprehensively with varieties, soils and site, propagation, including the mixing of composts for both seed boxes and pots, preparation of soil for planting and the use of different types of manures, the method of planting and subsequent operations such as (*a*) staking and tying, (*b*) pruning and "stopping", (*c*) "setting" the flowers, (*d*) watering, (*e*) mulching and (*f*) top-dressing.

As is generally recognised, the chief cause of failure in the growing of tomatoes is attributed to the incidence of disease and it is interesting to note that no less than 22 pages of the bulletin are devoted to a description of diseases and pests of the tomato, together with suitable measures for their control. Since Dr. Bewley is an authority on diseases of glasshouse plants the information under this heading is of particular value to tomato growers.

The final section treats with the construction of glasshouses suitable for the cultivation of tomatoes and gives specifications of the type generally employed in the tomato industry at home.

Although the bulletin deals essentially with the cultivation of tomatoes under glass it contains information of much value to tomato growers in

the tropics, where the crop is invariably grown in the open.

B. B.

Ducks and Geese.

By Capt. J. K. Lipscomb and H. Howes, 88 pages, illustrations. Bulletin No. 70, Ministry of Agriculture and Fisheries. H.M. Stationery Office, W.C. 2. Price 1 shilling.

Although this bulletin is primarily intended for the producer on a fairly substantial scale working under home conditions, it contains much valuable information which should be of use to the prospective breeder in Malaya. Ordinary fowl breeding on a commercial scale is still very much in its infancy in this country and it is certain that the rearing of ducks and geese has received even less attention.

The bulletin is divided into two parts, the first of which deals with table ducklings. After a brief introduction dealing with the London market requirements and the various systems of production available in Great Britain, the choice of site, housing and water supply are discussed. The comparative values of the various breeds are considered, and it is stated that the Aylesbury and the Pekin and their crosses are the only ones at present used on a commercial scale in Great Britain.

A short section on " Handling " shows that the temperament of the person who handles ducks has a material bearing on the success of his operations. A liking for ducks, and aptitude for hard and continuous work are essential to the successful duck farmer.

Other sections of interest to the prospective duck rearer in Malaya, deal with natural and artificial incubation, natural and artificial rearing, fattening, feeding and diseases.

The second part of the bulletin deals with geese and is on similar lines to the first part.

A foreword by the Poultry Commissioner draws attention to the fact that ducks can be kept in large numbers and in a limited area of land, and that their susceptibility to disease appears to be considerably less than that of fowls. It also points out that the cost of housing and feeding geese is low; little labour is involved in their management and, given free range over rough pasture, they require little attention.

H. L. B.

The Gardening Review.

This monthly journal is published in Madras and the annual subscription is six shillings. The July issue has an informative article on Potting and Potting Soils, which gives the formulae for potting soils as used in the Government Botanic Gardens, Bangalore, for various plants, palms, ferns and seeds.

Other articles of interest deal with pineapple cultivation, the mango tree, simple methods of propagation and miscellaneous subjects.

The Malayan Agri-Horticultural Association.

DEBENTURE ISSUE.

The following are extracts from a Special Meeting of the Debenture Holders on the 1st August, 1934 to consider revision of the debenture terms.

"Mr. Douglas proposes and Mr. McKellar seconds the following extraordinary resolution:—

1. " That the Association be released from its liability to the debenture holders in the sum of $25,922/- being arrears of interest payable on the $100/- debentures of the Association held by the debenture holders."

The extraordinary resolution is put to the meeting and carried by a show hands by 7 votes to 1.

Mr. Douglas then proposes the following extraordinary resolution:—

2. " That the debenture holders' rights against the Association be modified by the surrender of the $100/- debenture of the Association at present held by the debenture holders and the substitution therefor of two fresh series of debentures of $10/- each, one series to be called "A" debentures and the other to be called "B" debentures and both bearing interest at the rate of 2½% per annum, upon the terms that in exchange for every $100/- debenture held by any debenture holder there shall be allotted five (5) of the "A" debentures and five (5) of the "B" debentures and upon the conditions that the Association shall make every endeavour to redeem firstly the "A" debentures by annual drawings and, having redeemed the whole of the "A" debentures, secondly the "B" debentures by annual drawings."

After discussion Mr. Ross proposes and Mr. Wegener seconds an amendment that the interest rate in the resolution be 4% instead of 2½%.

Mr. Douglas then withdraws his original resolution and proposes a second amendment that the resolution be amended by the addition of the words "A debentures" in line 6 and by the substitution for the words "and both bearing interest at the rate of 2½% per annum" after the words "B debentures" in line 7 of the following: "bearing interest at the rate of 2½% per annum until such time as the "A" debentures have been redeemed in the manner to be provided and thereafter at the rate of 5% per annum." Mr. McKellar second this amendment.

The second amendment is put to the meeting and carried by a show of hands 6 voting for and 2 against. A poll is demanded and the second amendment is carried by 491 votes to 70."

Malayan Christmas Hampers.

Circulars have now been sent out as widely as possible giving particulars of the Christmas Hampers of Malayan produce supplied by the Association and already, at the same time of writing, last year's total of one hundred and eight has been passed.

The Hampers will contain the following articles:—

1 lb. Malayan grown tea, 1 lb. Malayan grown coffee, 2 tins Malayan pineapples, 1 Brazil nut fruit, 1 lb. ground nuts, 1 lb. candied lemon, pepper, cloves, nutmegs, mace, kerupok, gula kabong, 1 bottle mango chutney, 1 bottle salt fish puddah, 1 Port Dickson bag, 1 Kelantan Malay hand woven cushion cover, 1 Kelantan silver kris paper knife, 1 Kelantan silver kris brooch, 1 Trengganu carved match box cover and 1 Trengganu belt.

Each hamper will also contain an attractive leaflet with the name of the sender together with brief particulars of the gifts and an outline map of Malaya showing where the various articles come from.

The price of the hamper is $15/- which includes payment of duty and free delivery to any address in Great Britain and Northern Ireland.

Order forms giving full particulars can be obtained from the Secretary, Malayan Agri-Horticultural Association, 12, Barrack Road, Kuala Lumpur.

It is regretted that owing to unavoidable delay in publishing this number, the above notice is now out of date. We are glad to report, however, that the total number of orders received was 236.

Selangor Gardening Society.

The Selangor Gardening Society has progressed very favourably this year. We have quite a number of new members, and thanks are due to many who have kindly given lectures and have lent their gardens for these lectures.

The lecture on orchids given by Mr. Mungo Park, and held by kind permission in the garden of the Hon. Mr. Choo Kia Peng, was well attended, and most helpful to those whose efforts to grow orchids have not been attended with marked success. The last lecture, held on August 14th at the Central Experiment Station, Serdang, was also very well attended, and thanks are due to Mr. Milsum and Mr. Lambourne for their most instructive talk on marcotting, grafting and etiolation, and for escorting members round the Station.

The next lecture will be held in October and will be given by Mr. E. D. Butler, the subject being "Hints on Home Gardening." It will be held in the garden of the Residency, Kuala Lumpur.

The prize winners at the Selangor Gardening Society Show held at the Race Course, Kuala Lumpur, in conjunction with the Malayan Kennel Association Dog Show, on July 15th last, were as follows:—

Group.		Prizewinner.		Points.
1.	Miniature gardens.	Mrs. N. C. E. Miller	1st.	175
2a.	Flowering plants	Mr. Thurstan	1st.	100
		Mr. Thurstan	2nd.	50
		Mr. Colomb	3rd.	45
2b.	Flowering creeper	Mr. Butler	1st.	100
		Mrs. Watson	2nd.	50
3.	Collection of hill grown cut flowers	Mrs. Carmen Hill	1st.	100
		Mrs. Lander	2nd.	60
4.	Collection of flowering plants	Mr. Thurstan	1st.	200
		Mr. Butler	2nd.	150
5a.	Terrestrial orchid	Mr. Eu Kee Eng	1st.	150
		Mr. Mungo Park	2nd.	100
5b.	Epiphyte orchid	Mr. Thurstan	1st.	150
		Mr. Thurstan	2nd.	75
5c.	Cattleya orchid	Mr. Mungo Park	1st.	150
		Mr. Mungo Park	2nd.	75
6a.	Specimen ferns	(no first prize given)		
		Mrs. Frugtneit	2nd.	75
6b.	Specimen begonias	(no first prize given)		
		Mr. Butler	2nd.	60
6c.	Group of foliage plants	Mr. Chew Sze Foong	1st.	80
		Mr. Butler	2nd.	50

Group.		Prizewinner.			Points.
7a.	Collection of cut flowers -	Mrs. Thomas	-	1st.	100
		Mrs. Butler	-	2nd.	75
7b.	Single vase of cut flowers	Mrs. Doughty	-	1st.	100
		Mrs. Mungo Park	-	2nd.	60
7c.	Cut cannas -	(no first prize given)			
		Mr. Butler	-	2nd.	80
7d.	Cut hibiscus -	Mr. Eu Kee Eng	-	1st	100
		Mrs. Sanders	-	2nd.	75
8.	New introductions to local horticulture from another country or jungle flowering plant -	(no first prize given) Mr. Butler	-	2nd.	60

F. M.

District Agricultural Shows.

Kuala Selangor District.

The third Kuala Selangor District Agriculture Show was held on August 4th, 1934 and was opened by His Highness the Sultan of Selangor.

Exhibits in most classes were numerous. Fruit exhibits were few in number, owing to a poor mid-year crop, but of good quality. The vegetable section was the most outstanding feature of the show. Although not numerous, exhibits of coconut products, rubber and poultry were of a very satisfactory standard.

Departmental exhibits were staged by the Health, Co-operative and Agricultural Departments. A number of lectures, illustrated by lantern slides, were delivered on improved methods of copra production and on poultry management by a member of the Department of Agriculture.

Ulu Langat District, Selangor.

The third District Agricultural Show was held at Kajang on August 26th, 1934. The Show was opened by the Hon'ble Mr. F. W. South, Acting Director of Agriculture, S.S. and F.M.S.

The Show was not as successful as on previous occasions, insufficient notice having been given for the preparation of exhibits. With the exception of the Schools and Poultry Sections, exhibits were few in number. The Arts and Needlework and the Poultry Sections were very satisfactory and the exhibits of better quality than on previous occasions.

The Department of Agriculture staged exhibits and an officer of that Department delivered lantern lectures on poultry. The Health Department displayed exhibits concerning sanitation in the *kampong*, scavenging and conservancy, anti-malarial work and prevention of infectious diseases.

Kuala Langat, Selangor.

After a lapse of six years, an Agricultural Show was held in this District at Morib on 23rd September, 1934. This is the third Show to be held in the Kuala Langat District.

Heavy rain fell in the morning which somewhat delayed the opening, which was performed by H.H. The Sultan of Selangor in the presence of a large gathering that included The Hon'ble the British Residents of Selangor and Negri Sembilan.

The Show was housed in temporary sheds, which were tastefully decorated, each *Penghulu* being responsible for one section.

All the sections were fully occupied with the exhibits, in spite of the fact that poor exhibits were rejected before the staging commenced. One of the most successful sections was that devoted to padi. Rubber exhibits were few in number, but of greatly improved quality.

The Department of Agriculture, the Rubber Research Institute of

Malaya, the Health Department and the Infant Welfare Centre staged exhibits and demonstrations of an instructional nature.

A demonstration by the Malay Regiment and a display by four aeroplanes from the Kuala Lumpur Flying Club were the main items in an attractive programme of amusements which also included a physical strength display, fancy dress football match, a hockey match; and at night a Malay *ronggeng*, a *bangsawan* and a Tamil drama.

Besut, Trengganu.

The first Agricultural Show for the Besut District of Trengganu was held at Kampong Raja on September 6th, 1934.

Sections were provided for padi, fruit, vegetables, poultry, and arts and crafts and the general standard of the numerous exhibits was good. There were also some good samples of home-made coconut oil.

The Show was well attended and aroused much interest; it is hoped that another will be held next year when a better understanding of the object of such shows may be expected to lead to an increase in the number of exhibits.

Bentong, Pahang.

A District Agricultural Show was held, in conjunction with the annual buffalo show, at the Government English School, Bentong, on Sunday, 9th September. The opening ceremony was performed by the Hon'ble The British Resident of Pahang in the presence of a large audience.

The usual competitive sections were provided but although exhibits were numerous, the general standard of quality was only fair. It was unfortunate that exhibits were much too crowded which resulted in a large portion of them not been seen and rendered judging difficult.

Malay School basketry, silverware from Kelantan and hand weaving were also exhibited. The display of hand weaving by two Malay women—which many of the kampong folk in this District had never seen before—attracted much attention. Sarongs made from their looms were also exhibited for sale.

The Malayan Agri-Horticultural Association, Kuala Lumpur donated the following prizes: one silver medal, one bronze medal and four certificates of merits. They were awarded as follows:—

(1) Silver medal—for the most successful exhibitor in the Show; won by Mr. Ng Fook, a keen agriculturist in Bentong.

(2) Bronze medal—for the best exhibitor in cereals; awarded to Buyong bin Khatib Man of Kampong Lebu.

(3) The four certificates of merit were given to the most successful exhibitors in the vegetables, fruits, arts and crafts, and vegetables (grown by Chinese only) sections.

The Department of Agriculture staged an educational exhibit of local interest and two Malay Officers were fully occupied in explaining the essential points of the exhibits. In the evening lantern lectures were given on poultry

breeding and control of mouldy rot disease of rubber.

The buffalo show consisted of the winning beasts from the mukim competitions; some very excellent animals were exhibited.

In the afternoon a blow-pipe competition among the Sakais, a display of Sepak Raga by various teams of Malays and an exhibition of physical drills by two of the Malay Schools in Bentong were given.

In the evening, a ronggeng party from Kuala Lumpur and a squad of Sakais entertained the public with their music and dance.

Buffalo and Stock Show, Raub.

Of particular interest was the Buffalo and Stock Show held at Raub, on the 8th September.

Exhibits in the buffalo section were the prize-winning beasts from the mukim shows and accordingly were of a high standard of quality.

Classes were also provided for goats, milking cows with calves, and poultry; the exhibits in the last section were definitely poor.

The Medical Department staged an exhibit dealing chiefly with child welfare and control of disease.

The Department of Agriculture staged an exhibit similar to the one at the Bentong District Show; a lantern lecture on poultry-keeping was given in the evening.

During the afternoon a buffalo timber hauling contest was held.

The Show was an undoubted success as was proved by the numbers of entries and the interest shown by local cultivators.

Mersing (Johore) Agricultural and Industry Exhibition.

A two-day Agricultural and Industry Exhibition was held at Mersing, Johore, on 27th and 28th September 1934. In opening the Exhibition, the Dato Mentri Besar, Johore, stressed the importance of agriculture and village industries to small-holders in that part of the State.

Sections were provided for cereals, vegetables, fruits and village industries. The exhibits in the agricultural sections were not numerous, due in the case of cereals and fruits, to the unsuitability of the dates for holding the Show. The Show was originally fixed for June, but was postponed owing to unforeseen circumstances.

The Department of Agriculture staged an exhibit, and in the evenings delivered lantern lectures on agricultural subjects of particular interest to the cultivators in this District.